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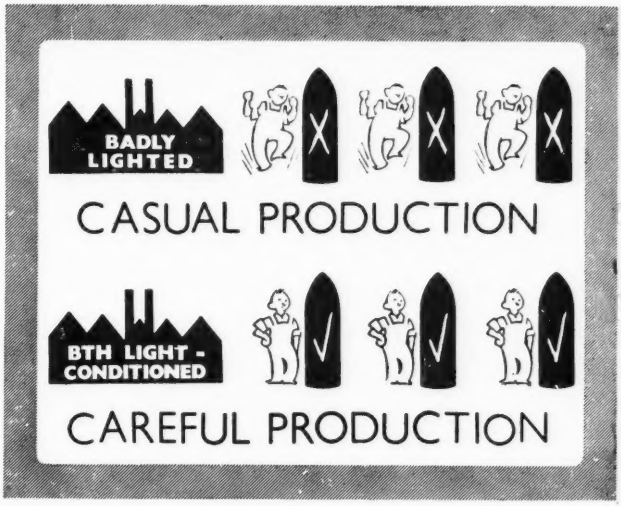

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ELECTRICAL REVIEW

Volume CXXX — No. 3367

Friday, June 5, 1942

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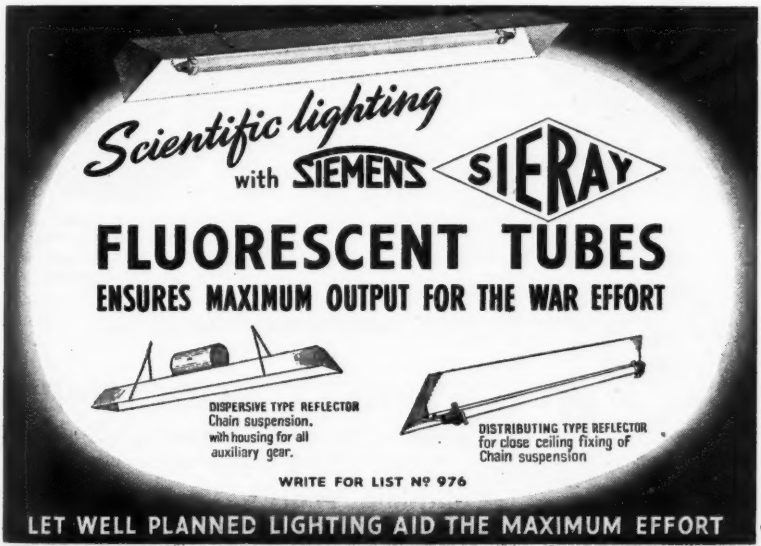
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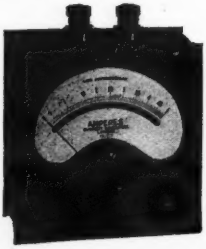

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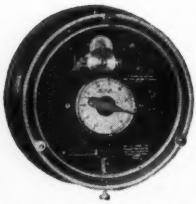

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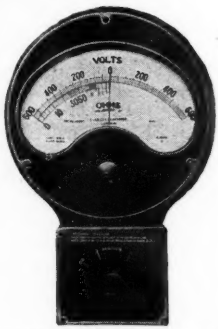

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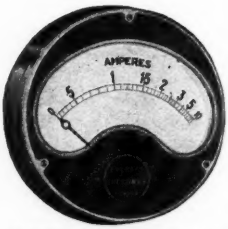

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXX. No. 3367. JUNE 5, 1942 6d. WEEKLY

The Industrial Structure

Combines and Foreign Trade

IT appears to be generally agreed that there was something wrong with our economic system before the war, but opinions differ as to the extent and causes of its mal-operation. Some consider that it was fundamentally unsound and should be entirely superseded while others think that the trouble arose from the failure of the system to adapt itself rapidly enough to changing world conditions. The latter maintain that it could still be made to work, with the necessary modifications. But there are so many doctors, each with a different diagnosis and remedy, that the patient is likely to be either over-stimulated or overwhelmed.

Small Firms' Future

One of the most important subjects under discussion is the future organisation of industry. The general idea seems to be that there will not be that scope for individual and isolated enterprise which was the mainspring of this country's progress for a century (or perhaps for centuries). It is true that the advance of civilisation, bringing with it the continued expansion of the number of purchasers, has favoured large-scale production and the formation of ever bigger industrial units.

Whether this tendency is to the ultimate advantage of humanity is one of the most-debated subjects of the different schools of economists. It raises two questions: First, will there be no room at all for the individual or small enterprise? and secondly, will the large-scale organisations be in the hands of "capitalists" or wholly or partially state-controlled?

As Mr. G. F. Sills shows in his article in this issue, the subject is very much bound up with the question of international trade. Mr. Sills presents the case for the large electrical combine, postulating the need for such organisations from the fact that our former principal competitors have operated on these lines and can only be met on level terms by corresponding groups of British manufacturers.

This is a point of view which found wide acceptance during the fiercely-competitive period between the wars and it visualises the resumption of that competition. But surely it was the scramble for markets that was one of the contributory (if not primary) causes of the war.

Competition or Co-operation?

This, however, does not necessarily invalidate the case for the large organisation which can be internationally co-operative as well as competitive. Yet we must be careful that an *imperium in imperio* is not set up and that any system of the kind operates for the well-being of humanity and not of a small part of it.

The questions here under consideration, however, are not the only ones that matter. While many fundamental commodities and services will no doubt be co-ordinated in the future—both nationally and internationally—we believe that the smaller manufacturing concerns will continue to make their contribution as an essential

part of the industrial system. Readers of Mr. Sills' article will no doubt want to express their views on the subject and we shall welcome them.

The F.B.I.'s Views

SOME of the foregoing points are touched upon in the report prepared for the Board of Trade by the Federation of British Industries. In this it is stressed that there are so many unknown factors that it would not be statesmanlike to attempt to-day to lay down definitely future industrial policy. This qualification necessarily makes the report a statement of probable problems without complete answers—but what more can be done at the moment? The F.B.I. shows itself to be fully aware that considerable changes of policy will be called for after the war, but it insists that while industry must suit its methods to the new situation this does not imply a complete break with the past. Wartime co-operation between the Allies, it is said, will form a starting point for an eventual wider international collaboration after the war. The continuance of Government control for some time after the war is recognised to be necessary, but a warning is uttered against excessive State interference.

Silver Replaces Copper

SINCE our leaderette on the suggested use of silver instead of copper in the United States appeared last week the *Electrical World* has come to hand with a statement that the thing is being done. The United States Treasury is "loaning" 40,000 tons of silver bullion to the Defense Plant Corporation, and perhaps to others, for electrical applications in new aluminium, magnesium and similar plants.

Charge Engineers' Salaries

THE position of the shift charge engineer in the modern large power station is very different from what it was when the N.J.B. Schedule was drawn up. Advancing technique has called for a corresponding advance in his knowledge and ability, apart from adding very considerably to his responsibilities. As a result the Electrical Power Engineers' Association has for some time been endeavouring to secure suitable recognition of the altered circumstances, and for the time being this has culminated in an award of the Industrial Court by which charge engineers in stations rated at over 100,000 kW are promoted from Grade 8 to Grade 7, representing an annual increase of between £40 and £50. The Association asked for the "up-grading" of men in stations rated at over 13,000 kW, and so it may be anticipated that the award does not finally settle the matter.

Compensating the C.E.B.

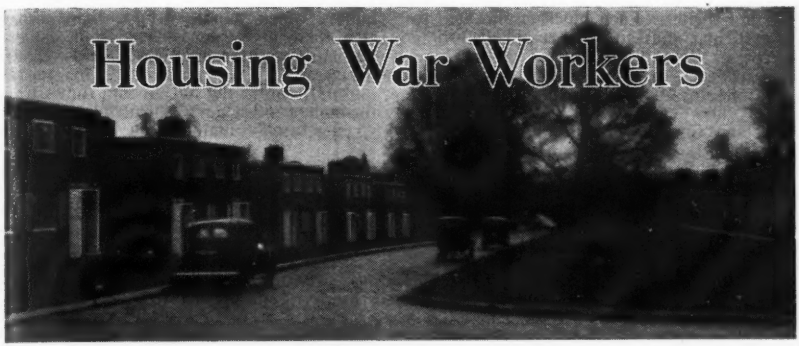
SPECIAL wartime conditions have resulted in a fall in thermal efficiency of generating stations operated under the direction of the Central Electricity Board and as a result the Board's finances, which are designed to produce the narrowest practicable margin, have been adversely affected. The necessity for the grid to pay its way is fully recognised by the electricity supply industry, and consequently a sub-committee has been set up consisting of representatives of the industry and the Board to consider a scheme whereby the Board will be reimbursed for any loss which it incurs.

Encouraging Economy

IT has often been felt that the two-part tariff, designed to encourage consumption in peacetime, is inimical to economy now. Consequently consumers should be allowed to change over without delays or formalities to flat-rate tariffs if they desire to do so and it is gratifying to see that supply undertakings are being urged to permit this by the Joint Committee of Electricity Supply Associations. Economy is urgently necessary but it seems that little is being done officially at the moment. Why has the Mines Department campaign not been continued and why isn't the B.B.C. being used to inculcate the need for using less fuel and wasting none?

Not Knots

HINTS on how to repair electrical apparatus given in the lay Press are not usually sound guides and those on mending flex contained in the current number of a woman's periodical are no exception. They provide, among other things, for the knotting together of the wires, and the example of the "granny" illustrated would be unlikely to withstand even moderately rough usage, which would result in a high-resistance contact and the generation of heat locally. That is why I.E.E. Regulation No. 605 (A) requires joints in flexible cords to be made by mechanical connectors shrouded in incombustible material contained within suitable receptacles.

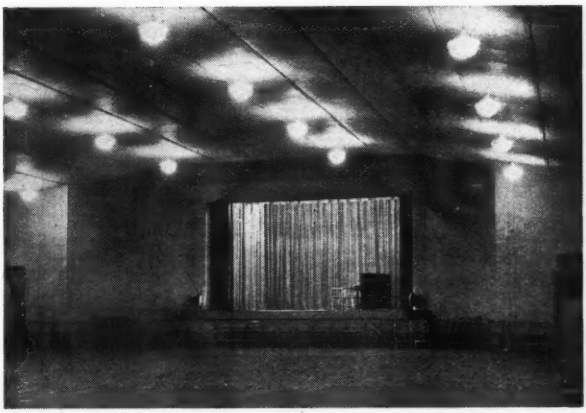


Use of Electricity in Ministry of Supply Hostels

OWING in no small measure to the speed and ease with which it can be installed, electricity has been adopted on a considerable scale for the various hostels which the Ministry of Supply is establishing to house armament workers in districts where the existing residential accommodation is inadequate. "Hostels," the name by which these establishments are officially known, gives a somewhat false impression of the scope of the schemes, which are, in fact, often more in the nature of small self-contained towns. One we visited recently, for instance, not only had catering and sleeping accommodation for 2,000 workers, as well as for about 60 staff, but also included an entertainment hall seating nearly 1,000, a gymnasium, games and reading rooms, hairdressing saloons, a laundry and a sick bay.

The general design of the hostel and the method of running it are on similar lines to holiday camp practice, and it is indeed not unlikely that after the war such hostels may come to be used as holiday centres. For the facilities offered men pay 27s. 6d. and women 22s. 6d. a week, including three good meals a day (a fourth is taken at the factory) and plenty of entertainment at nominal cost, arranged by a staff with practical experience in the running of the social side of holiday centres.

Roughly, the lay-out of the scheme is in two halves with the dining hall, entertainment centre, laundry, etc., in the centre. The living blocks, accommodating a hundred in each are arranged, not too symmetrically, on each side, with vegetable and flower beds between. Incidentally, there is sufficient vacant land on the site to produce practically all the vegetables required. Each of the bedrooms in the living blocks measures 7 ft. by 11 ft. and is equipped with a two-tier bunk, a double wardrobe, a chest of drawers and two chairs, all in an attractive colour scheme of grey, green or red. Wash basins in every room are supplied with really hot water from an indirect cylinder. Six baths are provided for each block and everyone in the block has his or her own place in the adjoining



Exceptionally good lighting has been provided in the entertainment hall

air-raid shelter. Each block is allocated to a particular shift so as to avoid disturbing sleepers. Speedy erection of the buildings was achieved by using either "Petrocrete" or a mixture of cement and sawdust for the walls, and concrete or "Thermocoust" boardings for the roofs. The other buildings, being of less standard design, are brick built.

To facilitate serving, the dining hall is divided into two sections with a central kitchen between and serving counters on each side. Together the two sections seat about a thousand people and at the moment deal with 2,500 meals per day, spread over 17½ hours. At present, until the hostel is completed, one section and an annexe are used as recreation rooms. A well-planned lighting scheme utilises Simplex pendant fittings housing 300-W lamps and provides an exceptionally well-diffused illumination of about 10 ft.-candles throughout. The rooms are warmed by "Copperad" fan heaters (British Unit Heater Co.) with hot water coils and ¼-HP motors.

In the kitchen is a larder equipped with large Frigidaire refrigerators for storing meat and fish. The food preparation equipment comprises two Peerless potato peelers (¾-HP single-phase motor with direct-on starting), a potato chipper (3-HP motor), a cake mixer (½-HP motor), a Crypto mincer (¼-HP motor) and an Asco slicer (¼-HP motor). As it has been considered advisable to be prepared for all eventualities, the actual cooking equipment, supplied by Benham Bros., Ltd., has been duplicated and divided between electricity and gas. There are also a few solid-fuel appliances.

Two roasting ovens (13·8 kW each), seven thermostatically-controlled steaming ovens (7 kW each), a three-pan fish fryer (24 kW) and various hotplates for boiling water, etc., form the main electrical contribution in the kitchen, while in each of the two buffets which handle drinks, light dishes, etc., there are water-jacketed milk boilers, hotplates, toasters and a 15-cu. ft. Frigidaire refrigerator. Seven extract fans (½-HP motors) remove the hot air and fumes from the boilers and steamers through large hoods. A 50-gal. self-contained water-heater loaded at 12 kW (spread over three phases) supplies a washing-up machine (¾-HP, single-phase Flather motor) provided in each of the washing-up rooms adjoining the two halves of the dining room. Extract fans remove the steam and hot air from these rooms. Cooking equipment in the sick bay and in the manager's house includes "Creda" cookers.

One of the washing-up rooms

A three-pan fish fryer used for the canteen

Facilities are provided in the entertainment hall for stage and cinema shows of all kinds, and about 600 people can dance comfortably on its excellent parquet floor. Stage lighting equipment (Strand) when completed will include two 1,000-W spotlights, twenty-four footlights, three 500-W batten spotlights, two 500-W batten floodlights, eight 500-W "Cyclorama" floodlights, two 500-W wing floodlights, and a 24-W board light, and there is a full-sized orchestra pit. In the

auditorium a general illumination of 10 ft.-candles is achieved by twenty-eight Simplex fittings housing 300-W lamps. Back-stage there is a 12-gal. G.E.C. water heater (loaded at 1½ kW) in each of the two main dressing rooms.

Under-eave wiring, two-phase and neutral, supplying the housing estate

In the laundry, where residents may do their own washing, the drying room is fitted with a Crompton extract fan, while twenty electric irons give ample facilities for finishing off the clothes, etc., in the ironing room. Here the temperature is kept at a comfortable level by means of three fan heaters (3-phase units) arranged for cooling the atmosphere as well as heating it.

Elsewhere, with the exception of the dining room which, as we have already mentioned, also has fan heaters, the building is heated by a hot water system employing a coke boiler and two circulating pumps. The larger of these, equipped with a 7½-HP Crompton "Klosd" squirrel-cage motor, is capable of handling 330 gal. per minute at a friction head of 40 ft., and the smaller (3½-HP motor) 120 gal. per minute. The larger motor is controlled by a star-delta starter and the smaller by a direct-on starter, both of Allen West construction. Due to the efficiency of the circulating system and the lagging of the pipes (most of which are overhead) the heat losses are remarkably low, being only about 15-20 deg. F. with a flow temperature of 180 deg. F. A check is kept on the temperature by means of a Drayton recorder.

Twenty electric irons are provided for the use of residents

Emergency lighting (12 V) is provided wherever it is thought desirable. Heayberd 2-A trickle chargers (30) serve to light the passages and the air-raid shelters of the living blocks, while the concert hall and dining room are catered for by two 10-A Crypton equipments.

Electricity for the hostel is supplied at 11 kV, three-phase, 50 cycles, AC, and taken via a Crompton Parkinson oil circuit-breaker to a 180-kVA Brush transformer, which reduces the pressure to the standard 430/230 V. To cope with the growing load (the maximum demand is already over 100 kW) this transformer will shortly be replaced by one of 300 kVA. On the low-voltage side the supply is controlled by English Electric "Combination" switch-fuse units with two outgoing 0.1 sq. in. four-core, lead-covered and served (but not armoured) cables feeding respectively the north and south sides of the site, with a similar separate feeder for the canteen, which is supplied under a special cooking flat rate. Ammeters are provided on each phase, the supplies to the various blocks being arranged to balance the load between phases. Following this practice the two sections of the dining hall and the kitchen are, for example, each on a different phase.

All feeders are underground double tee-offs with 4-core, 0.06-sq. in. cable serving buildings on each side. The leading-in cable

to each building is taken to a box (W. Lucy & Co.), compounded and sealed, and then on to the main switch, which is usually located outside the building. For the internal wiring galvanised steel conduits and v.i.r. cable are employed. Local protection and control are given by double-pole ironclad switch-fuses. A separate sub-switchboard in a corner of the kitchen splits up the supplies to the roasting ovens, steamers, fish fryer and the smaller appliances. Isolators are fitted on all the larger apparatus.

Not far from the hostel the Ministry of Supply is busy on another scheme designed to accommodate whole families rather than individuals. The present scheme provides for the erection of 124 two- and three-room flats and 76 five-roomed houses for letting at a nominal rent. The site chosen is one of the best residential areas in the district, and the attractive design and lay-out of the houses will no doubt be studied with interest by many when normal housing schemes are recommenced after the war. It speaks well for the method of construction adopted (utilising concrete very largely, even for the floors), that although building was started only nine months ago already over half of the premises are now occupied. Part of the estate is shown in the title illustration.

In every flat there is a 15-gal. electric water heater (1-kW Bray element) arranged to serve both sink and bath, while plug points permit the installation of similar apparatus if desired in the houses where back-of-grate boilers are installed. Every building is wired ready for electric cooking, but tenants make their own arrangements regarding apparatus. Actually to date 90 per cent. of them have decided to have electric cookers, which are available on credit sales terms from the local electricity undertaking (one of the Edmundsons group). To supply this estate the main feeders have been taken underground and carried up between the various blocks, with two-phase and neutral lines taken from eave to eave, the phases being balanced between the various houses.

We should like to thank the engineers, both of the hostel and of the electricity supply undertaking, for their assistance in the preparation of this article.

Research Co-ordination

SCIENTIFIC research and development within the British Empire was the subject of the Gustave Canet Memorial Lecture delivered to the Junior Institution of Engineers in London on May 22nd by Dr. A. V. Hill, M.P. (Foulerton Research Professor and co-secretary of the Royal Society and a vice-president of the Institution).

In indicating how closer and more effective co-operation within the Empire might be obtained the lecturer revealed that some basis already existed together with common standards by which its growth could be assured and measured. The common war effort had assisted various projects for the establishment of organised scientific collaboration with the British Dominions and the United States; attempts had been made, unsuccessfully so far, to establish similar arrangements with India.

It was impossible to achieve more than a small fraction of what was needed merely by correspondence, or the circulation of reports and drawings with specifications. Personal contact and personal initiative were needed also, for which it was necessary to provide permanent scientific liaison officers at various centres (as had now been done) with means of rapid transport for short visits by experts either way, while speedy transfer of documents and small samples was essential. The microfilm method and conveyance by air were of very special advantage.

Closer contact for frequent discussion of joint problems should be equally fruitful in the immediate post-war era as for making the most of common resources and heritage afterwards. Views expressed at a Royal Society conference were that interchange should occur not only between universities, but also between industrial and government laboratories in different countries, including the United States. The particular value of exchange between the universities of the Empire during undergraduateship, especially in applied science, had been urged. A scientific advisory committee in each Empire country with a cabinet minister as chairman could beneficially guide science into direct contact with the centre of government. The suggestions made at the conference might be the beginning of an important movement; further exploration and planning of concrete proposals was the concern of a committee whose secretary was Dr. Alexander King, scientific liaison officer in the Ministry of Supply.

As regarded the Colonies, Prof. Hill recalled the creation by the Colonial Development and Welfare Act, 1940, of two funds, one of £5,000,000 annually for ten years for development and the other of £500,000 annually without time limit for research, stating that a Colonial Research Advisory Committee was to be set up under the chairmanship of Lord Hailey to "advise upon and co-ordinate the whole range of research in colonial studies." He referred to the Imperial Institute's surveys of the Empire's natural resources and said that it had been suggested that Africa might be treated as a separate unit, a joint concern of scientific organisations of the United Kingdom and the Union of South Africa, since there was no other region in the world in which the same variety of research was needed.

Dr. Hill sounded a warning with respect to co-ordination: attempted direction, or control, would certainly be resented by those who prized the freedom of scientific research. In some way planning and freedom must be combined in different degrees in each country.

Fault Conditions

Relationship Between Cables and Switchgear

By "Thermal"

IN recent articles* details were given of an investigation into a breakdown of cables due to short-circuit currents consequent on bomb damage. As the maximum short-circuit current which a cable can safely carry for a given time depends on the final temperature, the temperature of the cable when carrying normal current is a determining factor.

In the absence of authoritative information from cable makers, an empirical value of 120 deg. C. final temperature is here assumed to be the safe limit for paper-insulated cables. This provides a basis on which recommendations as to cable sizes can be made, taking into account the normal current, short-circuit current and the time rating of the circuit.

It is not correct to assume that the cable is at its normal working maximum temperature when calculating the size of cable necessary. In many cases the size of conductor is determined by the short-circuit current and is, therefore, larger than would be necessary for carrying the normal current; consequently the temperature rise of the cable under these conditions is lower and the permissible temperature rise before reaching 120 deg. C. is greater.

** Details of an investigation into the behaviour of cables under short-circuit conditions were given in our issues of March 13th and 20th by Mr. E. A. Beavis. The author of the present article deals with the matter from the switchgear aspect.*

Short-Time Rating

Taking the 0.023-sq. in. cable mentioned by Mr. Beavis, the maximum short-time rating for a fully-loaded cable would be 2,900 A for 0.2 sec., or 1,840 A for 0.5 sec. If, however, the cable is normally carrying only 10 per cent. of its rated current, then the short-time rating becomes 4,200 A for 0.2 sec. and 2,660 A for 0.5 sec. At the end of these times, and with these currents, the temperature of 120 deg. C. will be reached and the currents limited by this consideration will be well within the mechanical strength of the cable for resisting bursting or contracting forces resulting from heavy magnetic fields.

The minimum cable conductor sections suggested by Mr. Beavis would be correct only if they were fully loaded, but as the fault analysed was on a 0.023-sq. in. cable with a load current of 80 or 90 A only, the minimum cable conductor sections for differing short-time ratings would be: for 0.2 sec., 0.15 sq. in.; for 0.5 sec., 0.25 sq. in.; and for 1.0 sec. 0.3 sq. in., as against the sizes he recommends of 0.25, 0.3 and 0.4.

Mr. Beavis concluded with a plea for co-operation by switchgear manufacturers in providing switches with a much quicker break to reduce the duration of the short-circuit and thus effect economies in the size of cables. He also referred to the various systems of discriminating protection in common use, in all of which time is an essential factor. The system engineer will not accept the suggestion that the cables shall be relieved of the possible duty of carrying short-circuit currents for a given length of time, but rather will insist that the cables shall be adequate for this duty.

It is fair to say that in no other branch of the electrical industry has there been more research than in that associated with the manufacture of switchgear, and the switchgear manufacturer has long since been forced to give proper consideration to the thermal rating of the switch and ancillary apparatus, in addition to its duty of making or interrupting the rating assigned to it for the prescribed duty cycle.

For this reason the British Standard Specification covering such apparatus provides for short-time ratings up to 5 sec., and means exist in the short-circuit testing stations in this country where, under accurately controlled conditions, apparatus may be so tested. Improvements have been made in the control of short-circuit testing plant which enable the short-circuit current to be maintained for a period of 5 sec. without detriment.

Thermal Rating and Contact Design

Determination of thermal rating is one of the first considerations in the design of switch contacts and until accurate and reliable data are established, it is useless to proceed with the design of any given switch as a whole.

In some contacts the limitation of the maximum current which can be applied is due to the asymmetric peak in the first half-cycle of the short-circuit, which may cause the contact to lift and thus commence arcing, but a balanced design can be produced where this lifting action does not take place and the carrying capacity for 5 sec. can be of the order of 9,000 A, RMS per pair of contacts.

The results of mechanical forces set up by high-value short-circuit currents often have to be seen to be fully appreciated, and only

tests under controlled conditions can effectively prove the design as a whole. Also, it is established that a minimum making speed of quite high value is necessary when dealing with a higher range of short-circuit currents. Similarly, the breaking speed is determined by the form of arc-control device used and must be maintained within close limits.

A complete knowledge of the characteristics of any system is necessary before a decision can be made in the selection of cables, transformers and switchgear. The selection of cables is governed by the maximum RMS short-circuit current which can flow for a period which will be determined by the system engineer according to the type of protective gear installed and with an accurate knowledge of its operating characteristics. The maximum time is usually two seconds, but cases may arise where time up to five seconds must be allowed for.

Preventing Mechanical Damage

With three-core cables, p.i.l.c. and armoured, it can generally be assumed that no mechanical damage will result from a short-circuit. Where single-core cables are used, however, the cables must be supported so that the forces imposed will not cause damage. In the case of a three-phase short-circuit, the cables will tend to move away from each other by a force which can easily be calculated from the value of the current. This condition is more likely to occur on low-voltage systems where the current is proportionately higher than on high-voltage systems. To attempt to remedy this condition by placing the cables far apart increases the reactance of the circuit and hence the volt drop. This is particularly important where two or more transformers are running in parallel, when the reactance of the leads connecting the cables to the switchgear should be as nearly as possible equal to ensure proper load sharing. There are other considerations of equal importance which cannot be dealt with here.

A reactor for limiting short-circuit current must have a through-current value equal to the maximum short-circuit current which can flow over a period exceeding the total time the fault condition can exist. I have had experience of a very serious fire caused by a set of oil-immersed iron-cored reactors of inadequate thermal capacity, and this was certainly not an isolated instance. The reactors should, therefore, have a thermal time rating of at least 5 sec., since two or more reclosures of the circuit may take place in an attempt to isolate the faulty section.

Thermal rating of transformers must also be selected on the basis of the maximum time that they can be subjected to short-circuit conditions, again taking into account the possible reclosures of the circuit. The transformer designer is conscious of both the thermal effects and mechanical forces, but he needs to be informed of the duty expected of a transformer.

The responsibility rests with the purchaser of stating the system conditions so that the switchgear engineer may select from the range of available apparatus what best suits the particular job. Apart from working current and voltage and information on the system connections, only two figures are necessary. The first is the current which can flow under conditions of total short-circuit adjacent to the switchgear, and the second is the maximum duration of this current in seconds.

An approximate value of short-circuit currents can be obtained by a supply undertaking, from whom an industrial consumer should obtain a declaration of the possible short-circuit value at his incoming terminals.

Thermal capacity can be determined by a supply authority with full knowledge of the system characteristics and the intentional time delays introduced into the operation of switches, having regard to their position on the system. In the case of the consumer, thermal rating will be determined by the operating characteristics of the switches he employs and again by any time lags introduced to prevent their instantaneous operation. It is equally important that this time should not be stated to be the maximum automatically as, while no difficulty is found in providing even a 5-sec. rating with the switch, isolators, bus-bars and the like, difficulty is experienced with instruments such as current transformers and, in some cases, the instruments connected to their secondary sides.

Current Transformer Burden

In B.S.S. 81, table 10, standard ratings of 0.5, 1, 2, 5 and 10 sec. are tabulated with corresponding maximum current densities in the primary windings which range from 150,000 A per sq. in. for 0.5 sec. to 33,000 A per sq. in. for 10 sec. Below this table is a reminder of the electro-magnetic forces that occur due to the initial peak current which is of the order of two and a half times the RMS value. A study of this Specification will show that proper consideration has been given to short-circuit conditions, and in Appendix C a careful explanation is given of the over-current rating of current transformers with examples of calculations. Appendix D points out that there is an upper limit to the rated burden to be expected of a current transformer having a single-turn primary, and it follows that where a normal primary current is small, the ampere turns must be relatively great to achieve a given output at a given accuracy.

Therefore, when small primary currents are specified, it is sometimes impossible to provide a current transformer having the

output and accuracy desired and at the same time the thermal rating to meet the short-circuit conditions, quite apart from mechanical considerations. Potential transformers are not affected by short-circuit conditions except in so far as the fuse which protects the primary winding must be capable of interrupting the maximum fault current.

Just as the switch thermal rating is determined under closely observed conditions in a testing station, so data are available to determine accurately the mechanical supports necessary for all connections and bus-bars. With any form of contact, including isolators of all kinds, it is desirable that tests should be carried out.

The switchgear engineer is often frustrated by lack of accurate information on the system conditions and by the methods employed of taking connections to or from the switchboard, which are outside the scope of his contract but not of his interest. It is therefore the duty of the cable engineer to state, not only the normal current which the cable will carry with a given temperature rise, but also the current rating under short-circuit conditions from 0.05 sec. to 5 sec. The user would then be able to make a proper selection. Often very small cables and inadequate fusing devices are connected even to system bus-bars where the current at 25,000 kVA is of the order of 36,000 A.

While a carefully designed fuse limits the maximum peak current which can flow through the cable and can be regarded as a thermal link, yet if a short-circuit at the fuse itself cannot be cleared, a resulting fire may cause a major short-circuit. With currents of this order, a cable should not be attached to a terminal with a single bolt, if, as a result of forces between the conductors, this may rotate and come into contact with either another phase or earthed metal. A bracing member sufficient to prevent movement of cables is necessary.

In conclusion, short-circuit testing stations in this country, which were primarily designed for the testing of switches, have proved of inestimable worth in determining the limitations of materials and apparatus.

National Tariff Policy

Impossibility of Accurately Apportioning Costs

By F. J. Elliott, M.I.E.E.
(Wolverhampton Electricity Department)

IN a recent leading article in this journal it was rightly stated that "the chief obstacle to the adoption of a common system of tariffs is the wide diversity in the cost of production which exists in various districts." The availability of standard grid tariffs leads many to believe that costs are standardised throughout the country. Those engaged in the supply industry are fully aware of the true position, and it is very desirable that others interested in the cost of electricity should be fully cognisant of the facts.

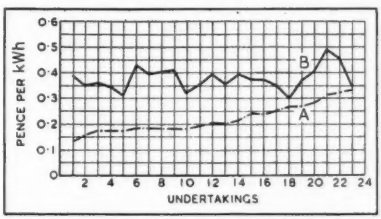
Some 70 per cent. of the cost at consumers' terminals is absorbed by (*a*) cost of energy and (*b*) capital charges. It follows that standardisation of the costs falling under these two heads is of primary importance. An examination of the relevant figures will show how far this has been attained by existing legislation.

Cost of Energy

Prevailing conditions render impracticable consideration of the figures for the whole of the authorised undertakings. For the purpose in mind, and to facilitate direct comparison, attention is here confined to undertakings owned by local authorities, and it will be sufficiently accurate if only those selling over 100 million kWh per annum are dealt with.

Running costs of generation of these undertakings vary from 0.13 to 0.33d. per kWh. These costs include only fuel, salaries and wages, repair and maintenance, oil, water and stores, and it is obvious that variations in the cost of fuel are chiefly responsible for the wide differences in running costs, amounting to 0.2d. per kWh from the lowest to the highest in this comparatively small group.

It is safe to assume that the owners of these "selected" stations are re-purchasing their requirements from the Central Electricity Board under Section 13 of the 1926



Variations in costs between different undertakings: A.—Running costs only. B.—Total costs, including capital charges and rates

Act, and to arrive at the running costs to be paid the cost of fuel throughout the particular area is averaged, thus producing a levelling effect. Any levelling effect thus produced is cancelled out when capital charges and rates

are added to give the total cost per kWh, the difference between the highest and lowest still remaining at the same figure.

The load factor of these undertakings varies from 30 to 50 per cent., and if purchasing on a grid tariff it would vary the cost to the extent of approximately 0.12d. per kWh, so that load factor alone does not account for the differences. The remaining costs from station busbar to consumer's terminals necessarily vary to a wide degree, being so greatly affected by the proportion of total output sold at primary voltage, the geographical nature of the area of supply and the apportionment of the premises in that area.

Many are now advocating the adoption of standardised methods of charge, but the facts quoted show the impossibility of devising a standard method where there exist such wide differences not only in the total cost but in the ratio between the fixed and running costs. In any case the consumer will not be satisfied with a standardised method of charge if it does not result in a standardised cost per kWh, the only yardstick which he understands.

The tariff problem is confined to domestic, shop and commercial premises. Large industrial users are adequately catered for by two-part maximum-demand tariffs. The present state of tariffs is almost entirely due to the attempts made over many years to apportion accurately the cost of affording supplies of electricity for each particular use. The resultant chaos is sufficient indication of its impracticability.

It is time the industry realised that the consumer is not interested in exact costing as he is well accustomed to paying a standard price for many articles in daily use, whether purchased within a stone's throw of the place of manufacture or many hundred miles distant. A consumer desires a means of obtaining light and heat at a reasonable and understandable cost, and there is nothing to prevent the charges made for electricity conforming to the universally recognised principle of reduction in cost per article with an increase in the number purchased.

This tariff problem is as old as the industry, and the following extract from a discussion before the Institution of Electrical Engineers in 1908 (Vol. 42) is not inappropriate to-day:

". . . Has not the cost of getting ready to supply been incurred on behalf of every ratepayer in the compulsory area, and ought not, therefore, every ratepayer to contribute? Though one does not want to walk on the sea-front promenade one has to pay rates towards its maintenance. Though one does not use the Public Library, nor the Public Baths, nor the Public Washhouses, one has to contribute to the rates in respect thereof. Why not pay, then, for having brought to one's door the means of obtaining pure artificial light and cheap power?

" It comes to this, that the standing charges should be met by a general rate levied on all ratepayers in the area of supply, while the production charges should be met by a flat rate for current supplied . . ."

Opal Glass Lighting Fittings

POST-WAR requirements in illuminating glassware were commented on by Dr. S. English (Holophane, Ltd.) in his presidential address to the Society of Glass Technology, recently delivered at Sheffield. In his opinion mere copying of Continental types would not suffice, for he considered that such ware should be of characteristic British style.

Predetermination of the performance of opal glass fittings must take the glare effect into account; for optimum seeing conditions excessive brightness must be avoided, 5 candles per sq. in. being regarded as satisfactory in this country for interior lighting fittings. For example, if 58 candles per sq. in. represented the surface brightness of a pearl bulb containing a 100-W filament, it was necessary so to design glassware, say for a diffusing globe, that it would reduce the bare bulb brightness without diminishing the light output ratio too greatly.

In the case of opal glass, available data permitted such design with the aid of quite simple mathematics, laboratory tests having confirmed the results calculated by algebraic methods. In practice the procedure could be considerably shortened, since the sums of portions of light transmitted and absorbed at all stages subsequent to the first (directly incident) were proportional to the diffuse transmission and absorption factors. Therefore it was necessary only to calculate the first stage and then work out the transmission percentage of the first reflection for addition to the first transmission figure.

Such calculation was based on the employment of a perfect glass sphere and a source of symmetrical light distribution. As lamps did not in practice comply with those ideal assumptions, the illumination at the first stage must be calculated in conjunction with polar distribution curves for various areas of the glass globe; at all subsequent stages the light would be diffused, so that the previous method could be applied. Similarly, in the case of non-spherical globes, the illumination could be calculated for various areas in the first stage and then, provided the shape were not extreme, the original procedure could be followed for the remaining stages. Allowance must be made for the zone containing the globe-neck opening, according to whether a reflector were provided there, otherwise some light would be lost in the canopy.

Finally, Dr. English referred to possibilities of imparting artistic texture-like surface finishes to glass, which would improve the suitability of its appearance and enhance its attractiveness when it came on to the market.

Production and Export

Advantages Possessed by the Large Group

By George F. Sills,
M.I.E.E., M.Amer.I.E.E.

THE views expressed in this article are personal ones which I have held and discussed verbally for quite fifteen years. They aim at devising a reasonable and practical method of ensuring the employment of far greater numbers in the electrical manufacturing industry, with continuity of employment and greater security than is possible with the present organisation of the industry. The suggestions are not made with the object of the aggrandisement of the large composite companies, but with a view to improving our position in the export market with no disadvantage to the home user.

It may be objected that the policy recommended would stifle initiative but, on the contrary, experience of even only the past ten years has shown that the keenness of the rivalry between the large corporate firms has been fierce, and as a result technical development has been continuous. This development has also affected a correspondingly large number of users directly and indirectly, whereas a development confined to a small firm has a limited application and return from the national point of view. Small and medium firms must naturally be followers to a large extent, and once an article of the popular type has been developed they share in the market, but usually have not contributed in the slightest degree to the effort and heavy expense required to bring the development to fruition.

Service for Overseas Buyers

The export market is vital to the British electrical industry. Manufacturing facilities in this country are far larger than can be absorbed at home, and it is probable that of the pre-war exports of electrical machinery and switchgear, about 80 per cent. was carried out by four composite groups. One of the reasons is that there are few firms capable of this work, and it is only these firms that are in a position to give service and repair facilities for heavy equipment installed many thousands of miles away.

As these concerns are undoubtedly a national asset in the broad sense, they are of benefit to every individual in Great Britain. They provide the highest type of technical and commercial training which is an essential supplement to the university and technical college training, and are necessary to the maintenance of the world-wide status of members of the Institution of Electrical Engineers. If we are to hold our own in comparison with foreign nations in technical matters, we must have a standard of practical technical knowledge which it is quite impossible to obtain with small firms, whose activities are necessarily extremely limited. It will be found that the main bulk of electrical exports of the type referred to from other countries is in the hands of not more than two large manufacturers per country. For instance, practically the whole of the American electrical exports are from two huge organisations. The same applies to Germany and Switzerland, and Sweden has only one.

It is not that there is any desire to push small firms out of existence, but it is self evident that the presence of a considerable number of small electrical firms has not been in the true interest of this country. Mr. J. R. Beard, Past-President (1940-1941) of the Institution of Electrical Engineers, in his presidential address stated :—"Modern economic and industrial development demands inexorably the organisation of both production and distribution on an ever-increasing scale, accompanied by the elimination of wasteful competition and a wider extension of monopolistic concerns."

Mr. J. W. Thomas (Electrical Power Engineers' Association) in his address at the post-war planning meeting in February last of the North Western Centre of the I.E.E. said :—"The units in which business and manufacture are organised have been growing larger and larger, until just before the war, a few were almost world-wide monopolies and many of them extended their ramifications throughout the country. It is fairly certain that this process must continue as it is dictated by technical advances whose full benefit can only be reaped if organisation is on a large and comprehensive scale. These forms of organisation have already outlined the type of economic system of the future. It is bound to be more centralised and wider in extent. The day of small units and free competition is rapidly disappearing."

Better Conditions

It is also an undeniable fact that the really large organisations do give working conditions, clean hygienic premises and social activities, which cost them money, and are a definite tangible asset to the manual worker and staff. They are amenities quite beyond the capabilities of the average ordinary firm. For example, a small firm is just unable to run a pension scheme for the people not covered by any Government scheme.

Only large firms are able to offer ample

facilities in their own works for the training of student engineers and craftsmen. Special courses are provided for both these types of men, and trainee lectures are given by the senior technical engineers on their staff. This is not very feasible in a small firm. Such practical lectures are not obtainable elsewhere, even at universities, therefore these facilities mean the reinforcement of theoretical training.

A small or medium firm is quite unable to finance and build a high-power testing station, together with attendant research laboratories. It is only by having such facilities on its doorstep for its own use that a firm can test and proceed without undue delay in new developments and so keep abreast of the times. The individual possession of such a testing station has great influence on the foreign buyer. Ultimately, the user gets the benefit of all this work.

Loss of Investments

Hitherto a large income from overseas investments has helped appreciably to pay for imports that have contributed to our high standard of living. Mr. Winston Churchill and other Government spokesmen have reminded us that we have lost a great deal of these assets, because certain foreign countries and Dominions since the war began have purchased the holdings in those countries and Dominions of people resident in Great Britain, and the income will not be available in future. The plain truth is that we are fast becoming a debtor nation to certain important countries. In addition to the effort required to re-establish our electrical exports, the country will be compelled somehow to increase overseas trade to make up for this loss of the national income. Unless this can be done, the position will be equivalent to that of an individual having, say, an income of £1,500 of which £1,000 is salary, and £500 dividends, who finds himself deprived of a considerable portion of the latter, and compelled to manage on a seriously reduced total income with higher all-round expenses.

A great many millions of pounds of British investments overseas has resulted in millions of pounds of equipment being purchased from this country, which would more than likely have been purchased from some other country if it had not been for our financial interests. Is it not plain that with a great fall in exports our vaunted high standard of living will decline? The work of the last few generations which has been so helpful is being liquidated, so buyers must for their own personal welfare support in a practical way the large organisations whose continued success in the extension of our country's exports is vital. Too many people are misled into regarding the prosperity of a large company as outside their own world, whereas it is fundamental that the well-being of everyone in the electrical industry and elsewhere is unquestionably bound up with the success of such organisations.

It would appear that there is only one way of achieving the desired expansion as applied to the electrical industry, and that is by obtaining the larger types of contract for export valued at hundreds of thousands of pounds per contract. These large export orders are subject to world-wide competition. There are often long periods between them, but meanwhile the few companies in this country who are competent to undertake them must have ordinary work "to fill in the valleys" in the factory programme, in the same way as an electricity undertaking has to function.

There is a reasonable practical way which, if followed, will undoubtedly increase general employment on electrical machinery and equipment of the large type which, in its turn, will involve still more employment for the smaller types of goods made by the same large manufacturers. The crux of the matter is that with reasonable prices fixed for the home market, the really important contributors to our foreign trade will receive automatically work for the home market from all departments, including the services controlled directly or indirectly by the British Government ; also from electricity undertakings a high percentage of the standard " bread and butter " electrical requirements such as substation equipment, motors, fusegear, domestic apparatus, meters, welding apparatus, etc.

We must either be content to accept the unemployment situation which existed before the war, or adopt new measures to give more employment after the war, even if these new measures do hurt a small minority.

More Employment

It is quite feasible for the very few really large firms to absorb the personnel of the smaller ones, and, what is much more important, to give employment to thousands more than the total number now employed by the smaller firms. However, this could only be achieved if, as is suggested, a steady flow of orders for daily requirements is received by the large firms, so that the desired load factor is attained. This would then place the main exporting firms in a far better position to obtain still further export business. We shall undoubtedly hear howls of lamentation, as we are so slow in accommodating ourselves to progress.

Millions of pounds in wages have been paid by the few very large electrical composite manufacturing groups, who, through their initiative, highly-qualified technical staff and financial backing have brought into being a considerable number of large electrical generating schemes both in this country and abroad which would not otherwise have been developed.

The vice-president of the second largest electrical manufacturer in the United States

recently stated that his company's daily output exceeded £200,000, namely, £73,000,000 per annum, and next year would be £300,000 per day, or £119,000,000 per annum. These figures make any electrical firm or composite group in Great Britain look small. The average engineer in this country has no conception of what really large output means, and the advantages accruing to a country with only a few huge companies.

It is not suggested that a factory should be several square miles in extent, or even that a very large company requires huge individual factories, because the ideas expressed envisage a grouping of all existing works into a maximum of, say, four organisations of the type referred to. A very large manufacturing company is of great value to labour, as it is not so susceptible to variations of demand for one or more particular products. If the demand on a small firm for its one or two types of apparatus falls off quickly, it must automatically discharge employees, as it has not a whole series of products to which the labour can be transferred in the same factory, and for which the demand may have actually increased. This is a decided advantage to workers, as it is not so apt to upset their family life, by forcing them to give up their homes and find work in another town.

Post-War Handicaps

After the war there are three things which will be a severe handicap to our exports, namely :—(1) Our high standard of living ; (2) extremely high taxation ; and (3) some of our main export markets which we have supplied to a large extent in the past (for instance, South Africa, Australia and India) will be more self-sufficient through having been forced to take up manufacturing on account of war necessities and political outlook. Indeed, there are possibilities that we shall experience serious competition in other markets from the Dominions themselves.

We know to our cost the devastating result of other nations having taken up their own production of cotton goods, which put many thousands of operatives in this country permanently out of work.

One positive way in which the matter may be facilitated is for the Government, *via* the C.E.B. and Electricity Commissioners, to make a long-term programme for the home market to obviate manufacturers being overloaded in the making, say, of large turbo-alternator sets with tremendous activity for three years, and then inactivity for the next three years, with consequent unemployment of skilled labour. The companies who manufacture this type of plant should be given work for a normal output over a number of years.

It has been suggested that there is one other way of ensuring more and continuous employment, that is by lowering the standard of living, but all shades of political opinion have repeatedly reiterated that this would be a retrograde step, and that we should endeavour to have an even better standard of living after the war. This will be wishful thinking unless we follow some course of action such as is recommended.

A Moral Obligation

Instances often occur of wealthy industrial organisations of all types and even of individuals—many of whom are in sheltered industries, *i.e.*, their product or their own profession is protected by associations or unions—accepting the lowest price for engineering goods. They do not consider whether or not the manufacturing firm is a national asset, or what are the conditions under which the goods are produced. Surely such protected organisations and individuals have a moral obligation to their country, their employees and themselves.

Some engineers have keenly felt the criticism of their abilities in the business world as distinct from pure engineering, and it may be that this has arisen through their lack of appreciation of the necessity of taking the broad national view.

The Atlantic Charter has been referred to in connection with international trade after the war. This article does not clash with this charter, or any formula arrived at between nations for international trade. The capabilities and efficiency of a particular industry in a country is purely an internal matter for that country.

A.S.E.E. Annual Meeting

BRANCH delegates and members from many parts of the country attended the annual meeting of the Association of Supervising Electrical Engineers in London on May 16th, when Mr. S. G. Christian, the chairman, presided and spoke of the growth in membership and of recognition of the Association which was now being increasingly approached by many bodies for its views, co-operation and collaboration. In spite of difficulties, the educational programmes carried out in London and the provinces bore testimony to the support received from the rank and file. The response to the Branch Papers Competition introduced during the year was very gratifying. Four new branches had been formed in the London area. The importance of the training and experience of the maintenance engineer, which had been referred to in the President's address, was emphasised by Mr. Christian.

The annual report of the Executive Council and the statement of accounts, which showed the Association to be in a strong financial position, were adopted. Voting for new members of the Council resulted in Messrs. J. J. Smith, J. Flood, J. J. Wilson, W. Rowland, J. S. Blacklock, T. Whetton, and A. Findlay being elected.

Resolutions passed included one covering the formation of a Rules Revision Committee.

Harmonics and P.F.

Increasing Importance of a More Accurate Definition

By G. W. Stubbings, B.Sc., A.M.I.E.E.

THE student of elementary electrical technology learns Ohm's law in the symbolic form $I = E/R$, which is equivalent to the verbal statement that the current in an electric circuit is exactly proportional to the voltage applied to it. By assuming the truth of this statement of the law, the student is enabled to solve a large number of simple circuit problems, and it is not until he progresses a little further in his studies that he finds its application to be limited and true only with important qualifications.

In simple metallic circuits with steady voltages, for instance, this expression of the law holds good only when the temperature of the material of the circuit is maintained constant. Again, with alternating voltages and with inductive circuits, it is true only if the frequency is also constant. If the magnetic flux causing the inductance flows in iron this interpretation of the law is not correct; even with constant temperature and frequency, current is not exactly proportional to applied voltage. Further, Ohm's law is known not to hold in certain circuits of an electrolytic character.

The discrepancy in cases like these is sometimes explained by using the fiction of a back EMF, but this begs the whole question. It is better to recognise that there are two distinct kinds of electrical circuits, the one in which Ohm's law as defined above is obeyed and in which current is exactly proportional to voltage, and the other in which this proportionality does not hold. Circuits of the first class are generally said to have a linear impedance; in circuits of the other class the impedance is designated non-linear.

An Unfortunately-chosen Symbol

Elementary AC theory is based upon the fundamental assumption of sinusoidal voltage-wave forms and linear impedances. With these assumptions, current-wave forms are also sinusoidal and power factor is the cosine of an angle of lag or lead. Because of this power factor is generally denoted as $\cos\phi$, a most unfortunately chosen symbol, because it obscures the fact that in a large and important class of circuits power factor is not determined solely by phase angle. It is regrettable that, in the early development of electrical theory, a characteristic symbol was not chosen for the important ratio, power factor. Had this been done, the inaccurate and unqualified identification of power factor with $\cos\phi$, common in the elementary text-books, might have been avoided.

Power factor is not the cosine of the angular measure of a phase difference but the ratio of watts to the product of RMS volts and amperes. When a sinusoidal alternating voltage is applied to a non-linear impedance it is almost self-evident that, due to the non-proportionality of current to voltage, the wave form of the resulting current must be different in shape from that of the applied pressure. A non-sinusoidal wave form is said to be distorted, and the distortion is due to the superposition on a sinusoidal and fundamental component of normal frequency, of a number of other sinusoidal components having frequencies which are odd multiples of the circuit frequency. These latter components, generally called harmonics, can be conceived to flow in the non-linear impedance simultaneously with the sinusoidal fundamental component, just as in ordinary circuits active and reactive current components are conceived to be simultaneously present. The presence of these harmonics calls for drastic modifications in the ideas of elementary AC theory.

Fundamental and Harmonic Components

To explain this point let us assume (what is conceivable although not practically realisable) that a non-linear impedance allows the passage of a current with a third-harmonic component having an amplitude which is one-half that of the fundamental component, when a sinusoidal voltage is applied to it. To produce the 50-cycle fundamental component will require power the amount of which is given by the usual formula $VI_1 \cos\phi$. Let us consider the relation of the 150-cycle harmonic to the supply. This is continually gaining in phase on the voltage, and in half a cycle of voltage change the harmonic current will pass through a complete cycle of phase change relatively to the voltage. The average power required to maintain the flow of the 150-cycle harmonic component is therefore zero. The same evidently applies to a harmonic of any frequency. Thus, the power in a supply to a non-linear impedance with a sinusoidal pressure is given by the usual expression $VI_1 \cos\phi$ where I_1 and ϕ, apply to the fundamental component of the current.

Although the harmonics in a distorted wave of current do not increase the power, it is almost evident that they must affect the RMS value of this current. For, suppose that the distorted current flows in an inductance-free linear resistance, the voltage drop in this resistance will have a wave form exactly similar to that of the current, and each current harmonic will be associated with a voltage-drop

harmonic of similar frequency. The power loss in the resistance will therefore be equal to the resistance value multiplied by the sum of the squares of the RMS values of the harmonics, and the square root of this power loss per ohm of resistance is by definition equal to the RMS value of the total current. Thus if this resultant RMS value is I and that of the fundamental component is I_1 and n_3, n_5 etc., are the relative values of the harmonics relative to I_1, then $I^2 = I_1^2(1 + n_3^2 + n_5^2 \ldots)$. The phases of the harmonics do not affect the RMS value of the current in which they occur. Thus considering the case of the current with a third harmonic equal to one-half the fundamental, the RMS value of this current will always be $I_1\sqrt{[1 + (0{\cdot}5)^2]} = 1.12 \times I_1$, although the harmonic may produce a symmetrical half wave of a peaked or a dimpled form or any unsymmetrical form intermediately.

We now see the important bearing of harmonic content on the power factor of a current. The VA in the supply giving the current is, with sinusoidal voltage V, equal to $VI_1\sqrt{(1 + n_3^2 + n_5^2 \ldots)}$, while the power is equal to $VI_1 \cos\phi_1$. The power factor is therefore $\cos\phi_1/\sqrt{(1 + n_3^2 + n_5^2 \ldots)}$, and if the circuit is inductance-free so that $\phi = 0$, then the maximum value of the power factor is $1/\sqrt{(1 + n_3^2 + n_5^2 \ldots)}$, and no ordinary power-factor correction can increase it beyond this maximum value. In the concrete case considered above, of a 50 per cent. harmonic, the RMS value of the current will be 1·12 times that of the fundamental component which with a sinusoidal voltage carries the whole of the power, so that the maximum power factor will be 1/1·12 or 0·895.

Resultant of Three Components

The foregoing discussion shows that when a current flows in a non-linear impedance in response to a sinusoidal voltage, the total VA of the load is the resultant of three components, viz., the power P, the reactive voltamperes Q and the harmonic voltamperes R, and that $(VA)^2 = P^2 + Q^2 + R^2$. Of these components Q can be modified by ordinary power-factor correction, but R cannot. The maximum power factor with a given current-wave form is $P/\sqrt{(P^2 + R^2)}$; this is often called the distortion factor and is indicated by the symbol μ. If ϕ is the phase difference of the fundamental component of the current relative to the voltage, then $\cos\phi$ is often called the displacement factor. The actual power factor of the load is $\mu \times \cos\phi$. Since the three components of a current of distorted wave form are of different characters, such a current cannot be represented by a vector in the plane of the vector of the voltage which produces it. The three component vectors must be conceived as mutually perpendicular, so that the harmonic component causes the line representing the total current to lie outside the plane of the voltage vector. This current line is not a vector in the usually accepted sense of the term.

The supply to a non-linear impedance must pass through line conductors, the impedances of which are generally linear. The effect of linear line impedance is evidently two-fold. In the first place it tends to decrease the current distortion in the load, and, secondly, it causes distortion of the line voltage in the neighbourhood where this load is absorbed, and so tends to produce distortion in the current taken by linear impedances.

Make-up of Line Loss

The effect of linear line impedance on the supply to non-linear impedance loads is peculiar. As each harmonic of the load current causes a separate component of the line loss, this loss will be made up of power components corresponding to all the harmonic frequencies. The distortion of the voltage wave at the terminals of the load circuit will also give rise to power components corresponding to these frequencies. But, if the supply voltage is sinusoidal, the whole of the output to the line must be in power corresponding to the fundamental frequency. The harmonic line loss must therefore be derived from the load which must receive fundamental power greater in magnitude than that which it absorbs and must return part of this back towards the supply, to be absorbed as harmonic losses in the line.

The supply to loads absorbed in non-linear impedances therefore brings considerable complication into elementary AC theory. Until recently this was a matter of mere academic interest, since nearly all AC loads were absorbed in circuits of linear impedance. The rapid development of lamps of the discharge class, which have a non-linear characteristic, and the practical certainty that the use of this type of lamp will increase very greatly after the war will remove this branch of AC theory from the academic to the technical field, and will call for a modification of the popular ideas about power factor, phase angle, and power-factor correction.

Saving Tin

OVER 2,000 tons of tin, or nearly 10 per cent. of our consumption annually, finds its way into anti-friction (Babbitt) alloys for the lining of bearings. It is estimated that 65 per cent. of this, that is, an amount equal to the entire output of the Cornish mines last year, can be saved if engineers, designers and others will help by applying certain recommendations of a committee of representative makers and users who have been investigating the matter for the Ministry of Supply. The Committee's report is available from the Non-Ferrous Metals Control, Grand Hotel, Rugby, or from the Tin Research Institute, Fraser Road, Greenford, Middlesex. All who install or maintain bearings are asked to bring their practice into line with wartime requirements.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Incendiary-Bomb Detection

MR. HAWKINS gives the impression in his letter in your issue of May 15th that the authorities do not approve of incendiary bomb detectors operating by impact because some types of impact do not give rise to a fire risk. If this is the case it is difficult to see why BS/ARP55, which deals with such a type of detector, was issued.

As regards the second paragraph of his letter, I think I made it fairly clear that the requirements set out regarding the operation of the alarm by bodies other than incendiary bombs were based on the experience of myself and my colleagues. We wished to know when any objects crashed through and damaged the roof, whether they were a potential fire risk or not.

It seems that a certain amount of the disagreement between Mr. Hawkins and myself is due to our having different types of buildings in mind. Mr. Hawkins appears to be concerned with factories containing large open spaces, whereas I have had in mind the office type of building having a number of rooms on the top floor with a ceiling and roof above them. In this connection I may say that one of the things which decided me against the photo-electric type of alarm was that practical experience has shown that incendiary bombs quite commonly get into the oddest places, *e.g.*, one fell through the roof and ceiling and got between the bath and the wall. There are also those that burn at the place of impact or roll into the gutter and set fire to the eaves. In warehouses bombs may lodge under obstacles or inside packing cases, when there could be a considerable delay before the alarm was given.

In addition it was not desired to limit protection to the hours of darkness, especially in summer. Though I have had no experience of incendiary bomb raids other than during the night, this was a possibility which could not be overlooked.

Mr. Hawkins says that the ideal incendiary bomb detector will detect nothing but incendiary bombs. I agree heartily, but would add that the ideal has not yet been attained. The light-sensitive alarm does not specifically detect incendiary bombs but any light of sufficient intensity.

The statements in paragraph (*a*) do not correspond entirely with practical experience. If h.t. batteries are referred to it is quite true that they are more or less impracticable. This does not apply to l.t. batteries, which are being used all over the world for a great variety of purposes with perfect satisfaction. The remarks with respect to connection to the mains do not correspond with the requirements and recommendation set out in BS/ARP60, paras. 7 (*a*) and (*b*), where it is stated that the alarm circuit is to be worked from a battery and that if the detector circuit is connected to the mains it is recommended that provision for battery operation be made in event of failure. My own experience in the two worst raids I have seen has been that the power supply failed. There is little satisfaction in knowing that the alarm is out of action at the time of greatest need.

I think Mr. Hawkins has misunderstood me in para. (*e*). I was not referring to the time between the passage of the bomb through the roof and its impact on the floor, but between its impact and the moment when it gives sufficient light to work a photo-cell alarm. This time interval can be from about, say, a second to half a minute or more, depending on the sensitivity of the alarm and the position of the bomb. The advantage, however, is small.

Gravesend. EDWARD BURKE.

Vacuum Cleaners

OWING to the increasing use of gas-producer plants for automobiles, it seems propitious to draw attention to the risks, unwittingly incurred by the layman, in the practice of using domestic cleaners for securing the initial draught to start the "fires" on these plants.

The majority of these cleaners are connected *via* twin flexible, and leakage due to defective insulation would pass unnoticed by the user in the average wooden floored and carpeted room, but the same cleaner, when handled by a car owner possibly with wet shoes and standing on a concrete garage floor, might result in severe shock.

Twickenham. W. MACMAHON.

[This emphasises the importance of observing No. 1001 (A) and (B) of the I.E.E. Regulations relating to the use of the same portable appliances in both earth-free and non-earth-free situations.—Eds., ELECTRICAL REVIEW.]

Heating Large Buildings.—Regarding his letter published last week, Mr. Gough points out that the end of the second paragraph, as printed, reads as if the electricity authority always requires a large room for the central heating plant. This should read that a large room would be wanted for central heating plant whatever its type. In the majority of cases, of course, this is not the concern of the supply authority. In the last paragraph "minimum demand" charges, should read "maximum demand."

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Electricity Committee of Battersea Borough Council has decided to extend by a year the services of **Mr. H. F. J. Thompson,** general manager and engineer, who will be sixty-five in September.

Mr. D. H. Davies, who has completed over forty-three years' service with six municipal authorities, is due to retire from the position of borough electrical engineer of Chesterfield on June 27th. The Electricity Committee, has, however, recommended his reappointment in a temporary capacity. **Mr. J. F. Peaker,** mains superintendent and assistant manager, is to be reappointed under similar conditions.

At a meeting of the Executive Council of the Association of Supervising Electrical Engineers on May 23rd **Mr. W. H. Brooks** was elected chairman, **Mr. J. Flood,** vice-chairman, and **Mr. J. J. Smith,** honorary treasurer, for the year 1942-4.

In our last issue we briefly announced the appointment of **Mr. G. A. Cheetham,** M.I.E.E., as managing director, and **Mr. J. R. Wilkinson,** B.Sc., M.I.E.E., as a director and sales manager of Ferguson, Pailin, Ltd.

Mr. Cheetham was educated at Manchester Central High School and Manchester College of Technology. After some years with Ferranti, Ltd., in the company's switchgear, meter and

Mr. G. A. Cheetham

Mr. J. R. Wilkinson

instrument departments he joined the British Westinghouse Co. (later the Metropolitan-Vickers Electrical Co.) in December, 1913, as designs engineer. He was later appointed chief engineer of the instrument and meter department and then manager and chief engineer of that department, responsible for the design and manufacture of instruments, relays, protective gear and automatic substations. Mr. Cheetham is also a director of Sun-Vic Controls, Ltd. In 1935 he was chairman of the North-Western Centre of the I.E.E.

Mr. Wilkinson was educated at Littleborough Central School and Manchester Grammar School, going from there into the Royal Artillery in the closing stages of the last war. After demobilisation he took an honours degree in technical science at Manchester University. From there he went as personal assistant to the late Mr. M. B. Field, of Kelvin, Bottomley & Baird, the scientific instrument makers. His career with Ferguson, Pailin, Ltd., commenced in 1921 and within a few years he was put in charge of the tendering and estimating department. In 1929 he was appointed London manager and has held this position until the present time.

Mr. H. M. Hawkswood has been appointed London manager of Ferguson, Pailin, Ltd., in succession to Mr. Wilkinson, and **Mr. L. F. Ryland** has been appointed manager of the sales engineering department in succession to **Mr. A. J. Nicholas,** who recently resigned.

Mr. G. A. Juhlin, M.I.E.E., has been elected to the board of the Metropolitan-Vickers Electrical Co., Ltd. He succeeded Mr. J. S. Peck as chief electrical engineer on the latter's retirement in June last year and has been a director of the Metropolitan - Vickers Electrical Export Co. since November, 1935.

Mr. G. A. Juhlin

In connection with the British Empire Scholarship Examinations for admission to Loughborough College in September, 1942, the College Authorities have awarded scholarships in the Faculty of Engineering (Electrical Department) to **Mr. O. R. B. Moorman,** Sandown Secondary School, I. of W., and **Mr. J. Pickering,** Devonport High School, Penzance.

At the request of the Minister of Supply **Sir Cecil Weir,** K.B.E., has been released by the President of the Board of Trade in order to take up the appointment of Director-General of Equipment and Stores in the Ministry of Supply, in succession to the late Sir William T. Wilson. Sir Cecil Weir, who was Controller-General of Factory and Storage Premises at the Board of Trade, will retain his membership of the Industrial and Export Council. The President of the Board of Trade has appointed **Mr. P. A. Warter,** the Deputy Controller-General, to be Controller-General of Factory and Storage Premises in succession to Sir Cecil Weir.

Dr. C. C. Paterson, O.B.E., M.I.E.E., director of the Wembley research laboratories of the General Electric Co., Ltd., gave a broadcast talk, in the Home Service on Saturday on "War, Women and Diamonds." He described how diamond dies for drawing tungsten lamp filaments are being made in this country by women. Until recent years these dies came from the Continent. The drilling of a hole of 0.0004 in. took about three weeks and involved a million impacts on a steel needle in a film of diamond dust. The particles of this dust had to be graded, for in the finishing process one particle of coarse dust might score the surface. The work had to be carried out to an accuracy of a four-millionth of an inch; any carelessness on the

part of the operator might throw away three weeks' work.

The first awards of the London Passenger Transport Board's certificate for brave conduct and devotion to duty during enemy attacks on London have been made to the following:—Messrs. G. A. Baker, technical assistant, and J. W. Hunter, inspector (restoration of services during air-raids after trolley-bus overhead equipment had been damaged); E. Fox, labourer (saving tram depot, vehicles and stores hit by incendiary bombs); N. G. Sisson and H. O. Trissler, permanent way engineers (dealing with delayed action bombs); G. Best, conductor (saving lives of passengers in blazing bus); and F. T. Maddock, road superintendent (arranging traffic diversions during raids).

At the annual meeting of the Institute of Physics held on May 28th the following were elected to take office on October 1st: President, **Prof. Sir Lawrence Bragg.** Vice-presidents, Dr. W. Makower and Mr. T. Smith. Hon. treasurer, Major C. E. S. Phillips. Hon. secretary, Prof. J. A. Crowther. Ordinary members of board, Prof. J. Chadwick, Prof. J. D. Cockcroft, Mr. D. C. Gall and Mr. E. W. Wedmore.

Acceleration of the increments in the salaries of a number of members of Glasgow Corporation Electricity Department was approved on May 28th. The salary of **Mr. G. Morgan,** general manager, is to be raised from £1,500 to £1,800 and that of **Mr. A. M. Estcourt,** commercial manager and secretary, from £1,000 to £1,150.

Glasgow Corporation Electricity Committee has approved the appointment of **Mr. W. W. Barrie,** senior assistant district mains superintendent, as district mains superintendent at a commencing salary of £581 per annum.

Mr. F. C. Horsford, who entered the service of W. T. Henley's Telegraph Works Co., Ltd., in 1911, and who for the past twenty years has been engineering sales representative for the London district, has been appointed engineering sales superintendent. **Mr. F. V. Vassiere,** who joined Henley's in 1924, has been appointed an assistant sales manager in succession to the late Mr. A. T. Crowe.

Mr. H. C. Green and **Mr. F. C. Mannox** have been appointed joint general managers of Murex, Ltd.

At the recent annual meeting of the London Chamber of Commerce **Sir Geoffrey R. Clarke** was re-elected president for the third year in succession.

Mr. P. S. Turner (director of A.E.I. and the Metropolitan-Vickers Co.) has been elected to the boards of the Edison Swan Electric Co., Ltd., and Edison Swan Cables, Ltd. **Messrs. R. J. Morris,** sales manager, and **F. Gale,** works manager, have also been appointed directors of Edison Swan Cables, Ltd.

Mr. F. E. C. Miller, London manager of the Edison Swan Electric Co., Ltd., has been appointed manager of the company's lamp sales department. He is succeeded as London manager by **Mr. H. A. Mumford,** and **Mr. G. N. Robbins** is appointed assistant manager of the Department.

Mr. A. G. M. Michell, F.R.S., of Melbourne, whose name is internationally known for the bearing which he invented, has been awarded the James Watt International Medal by the Institution of Mechanical Engineers. In addition to his work on thrust and journal bearings Mr. Michell has made valuable contributions to engineering science in connection with centrifugal pumps and crankless engines.

Obituary

Mrs. S. Rentell.—Many readers will learn with regret of the death on May 26th, of Sophie, the widow of the late Mr. Sidney Rentell who was the founder and for many years editor of *Electricity*.

Colonel G. C. Royce, V.D., whose recent death at Toronto at the age of seventy-three, is reported, was president of Ferranti Electric, Ltd. Col. Royce became associated with Sir William Mackenzie in 1902 as part owner and general manager of the Toronto Suburban Railway. In 1908 he organised the Ferranti Electrical Co., which subsequently became Ferranti Electric, Ltd.

Mr. H. Maitland.—The death occurred suddenly in Glasgow, on May 23rd of Mr. Henry Maitland, at the age of fifty-four. For many years Mr. Maitland held the position of mains superintendent to the Glasgow Corporation Electricity Department.

Mr. C. Leven.—The death is announced of Mr. Charles Leven, M.I.E.E., of King's Gardens, N.W.6, in his seventy-ninth year.

I.M.E.A. in Scotland

THE annual meeting of the Scottish Centre of the Incorporated Municipal Electrical Association was held in Edinburgh on May 22nd. Lord Provost Darling presided and proposed the toast of "The Association." He said that the people of this country could not look forward as a matter of right to the maintenance of a particular war standard, and would have to work harder and more intelligently and equip themselves better than hitherto. In the great effort that would follow the war it would not be sufficient to speak of having better housing, better lighting. The function of their Association in the difficult future was to produce a form of power which could be one of the main agents in the development of industry, and for the manufacture of products to export.

Mr. J. W. J. Townley, A.M.I.E.E., president of the Association, replying, paid high tribute to the maintenance of the electricity supply during the heavy air-raids of 1940–41, and said that the credit for the manner in which the emergency organisation had worked was due in large measure to the personnel on the job—the stokers and firemen at the stations who had to carry on with their jobs in darkness. He was very proud to be associated with an industry which had distinguished itself so well in such difficult conditions.

Remember: Waste Paper is War Material

COMMERCE and INDUSTRY

Industrial Court Award. *Generating Plant Depreciation.*

Shift Charge Engineers' Salaries

UNDER an Industrial Court award dated May 22nd all shift charge engineers in Class J, K, L and M stations are graded with allocation to Grade 7, and any increase in salary payable to them under Clause 43 of the Schedule will merge in the salary so awarded. Clause 43 provides for the determination of salaries to be paid in the case of undertakings operating in parallel with the system of the C.E.B. ; this arrangement is, by agreement, limited to percentage additions to the scale salaries varying from 2½ to 7½ per cent.

At the hearing on May 19th and 20th at York the staff side of the National Joint Board of Employers and Members of Staff (Electricity Supply Industry) asked that the change in grade should apply to shift charge engineers in Class F stations and upwards. In support of the claim it was submitted that the present Grade 8 was fixed on a basis of the assumed appropriate salary for a charge engineer under conditions in 1914, since when there had been technical advance and development of a character not catered for by classification increases. The operation of the grid system had also largely increased the duties and responsibilities of the charge engineer, and the whole tendency of power station design was towards greater complexity in order to achieve the highest possible thermal efficiency. This necessarily meant that the training and technical knowledge of charge engineers in generating stations of modern design must undoubtedly be higher than when the Schedule was originally negotiated.

On behalf of the employers it was stated that in the course of the negotiations between the parties an offer had been made in settlement of the claim by the concession of Grade 7 rates to shift charge engineers in undertakings in Classes J, K, L and M (*i.e.*, 100,001 kW and over). They claimed that any extension of the offer could not be justified having regard to the lesser responsibilities of the shift charge engineers in Class F, G and H undertakings.

Restriction of Resale

The Board of Trade has made an Order under Section 4 of the Goods and Services (Price Control) Act, 1941, revoking the existing Price-Controlled Goods (Restriction of Resale) Order, 1942 (S.R. & O. 1942, No. 64). The new Order re-enacts the main provisions of the previous Order with certain important changes. Under the new Order it is no longer a defence for a trader, charged with selling by wholesale goods which he has bought from another wholesaler, to prove that such transactions are a usage of his trade. Instead, he will have to prove (*a*) that, at all times since March, 1939, he was himself selling similar goods bought in this way otherwise than by retail, and (*b*) that he had reasonable cause to think that the goods he is charged with reselling were either imported by his supplier or bought by him directly from the manufacturer or importer. Subject to this exception, the resale by wholesale, without a licence under the Order, of goods bought from a wholesaler or factor is prohibited. Sales by wholesale include sales to retailers. Manufacturers who sell goods which are not of their own manufacture expose their wholesale customers to the risk of prosecution and should draw their attention to the fact.

With the important change mentioned above, the main provisions of the earlier Order are re-enacted. The commercial resale of goods bought by retail is still prohibited. The Order applies to all price-controlled goods, that is, to all goods for which maximum prices have been fixed by the Board under the Act and to all goods price-regulated under the Prices of Goods Act, 1939. An up-to-date list of the latter will be found in the Prices of Goods (Price Regulated Goods) Order, 1942, which came into force on May 11th. Applications for licences should be addressed to the Assistant Secretary, Industries and Manufactures Department, Division 1, Board of Trade, Millbank, London, S. W. 1. The Order, known as the Price-Controlled Goods (Restriction of Resale) (No. 2) Order, 1942 (S.R. & O. 1942, No. 958), comes into force on June 8th. Copies can be obtained from H.M. Stationery Office or through any bookseller.

Plant Depreciation

We mentioned in our April 10th issue that the Joint Committee of Electricity Supply Associations and the Institute of Municipal Treasurers and Accountants were endeavouring to secure an increase in the rate of wear and tear allowance in respect of generating plant—at present 6½ per cent. on the written down value, plus the cost of repairs. It is being represented to the Inland Revenue authorities that this rate has been rendered inadequate by war conditions which have imposed additional heavy burdens upon the plant. The proposal is that the rate should be increased by 50 per cent. (plus the additional allowance of 20 per cent. authorised by the 1938 Finance Act) for 1941–42 and during the war period.

It has been pointed out that towards the end of the last war special rates of depreciation were allowed—in the case of electricity undertakings the rate was increased from 5 per cent. to 7½ per cent.

Post-war Economy

The annual meeting of the London Chamber of Commerce was held on May 28th. In his address Sir Geoffrey R. Clarke (president) said that although at the moment our efforts must be entirely devoted to winning the war, it was essential to pay some attention to the post-war position, and to decide as far as possible upon a policy that would enable us to reap the greatest benefit from the new conditions that would prevail. All the old conceptions must be forgotten and we must be prepared for a complete reform not only in commerce and industry, but in our daily lives. Referring to the question of individual enterprise and State direction of economic activity, Sir Geoffrey said that in his view the State should determine broadly the directions in which our

economic resources should be employed, and should look to private enterprise to produce the desired results. Governments should avoid participation in international trade.

A system was required that would work not only for the benefit of those engaged in trade, but for the benefit of all mankind, and this could only be effected by enforcing the principle of the payment of international debts, whether they were financial, commercial or any other kind, by goods and services.

One of the most urgent problems to be solved was that of unemployment. The solution lay in better distribution, not in tampering with production.

Referring to the inequity of the Excess Profits Tax, Sir Geoffrey said that they wanted a definite assurance that 20 per cent. of the tax paid would be returned after the war.

Price and Quality of Coal

The Conjoint Conference of Public Utility Associations has sent to the Mines Department a copy of a resolution passed by its Coal Committee. This expresses the dissatisfaction of gas and electricity undertakings with existing coal arrangements and calls for the establishment of an independent body to settle disputes regarding quality, prices and allied matters between the coal suppliers and the undertakings.

The Coal Committee has also suggested that the question of transport costs should be given further consideration. It is maintained that if subsidies are granted they should be on a national basis.

Superannuation and War Service

The Minister of Labour and National Service has certified that employment in the electricity supply industry with an authorised undertaking within the meaning of the Electricity (Supply) Acts, 1882 to 1936, is employment for war purposes under the Superannuation Schemes (War Service) Act, 1940. Trustees or other persons concerned with the administration of superannuation schemes may, therefore, arrange, in accordance with the Act, to preserve the superannuation rights of any person leaving the employment in which he has acquired those rights to take up employment of the kind described. Information about the Superannuation Schemes (War Service) Act, 1940, may be obtained at any Employment Exchange.

Insurance of Commodities

The Board of Trade has, with the approval of the Treasury, decided that in respect of the period beginning June 3rd and ending September 2nd the rate of premium payable under any policy of insurance issued under the Commodity Insurance Scheme shall be at the rate of 5s. per cent. per month.

Post-war Housing

Making the house suit the needs of the family rather than the reverse, the best ways of heating and cooking, whether laundering should be done in the home or at a communal wash-house, the need for establishing new industries in the smaller towns, and the planning of housing generally are some of the matters to which attention is drawn at a women's exhibition on housing and planning organised by the Housing Centre and now being held at the Royal Institute of British Architects, 66, Portland Place, London, W.1. Ways of economising in the use of electricity are the principal feature of an exhibit by the Electrical Association for Women. The exhibition closes this evening.

Transference of Trained Women

It was reported to the London and Home Counties Joint Electricity Authority yesterday that a letter had been received from the Ministry of Labour and National Service in reply to correspondence from the J.E.A. regarding the Registration for Employment Order, 1941. The Ministry stated that it was appreciated that where employers had trained women to replace men it caused inconvenience to train older women to take their places. The need, however, to transfer younger women to vital war factories and the Services had increased to such an extent that this course was necessary.

Furnace Refractories

The second report (Special No. 28) on refractory materials of the Joint Refractories Research Committee of the Iron and Steel Industries Research Council and the British Refractories Research Association has been published by the Iron and Steel Institute, 4, Grosvenor Gardens, London, S.W.1. It is a 168-page reprint of some of the confidential bulletins prepared since the first report (Special No. 26) on this subject appeared three years ago, and includes a summary of other recent investigations.

Wartime requirements have stimulated research activity in this industry, which has greatly developed the co-operative spirit between manufacturers and users as well as investigators, with consequent better appreciation of the constitution and behaviour of basic refractories, particularly stabilised dolomite-steatite, which is a more readily obtainable alternative to magnesite. Studies have included X-ray diffraction powder examinations with a Debye-Scherrer camera, which method has only comparatively recently been applied to ceramic material. Although a considerable number of investigations have already been made, most of them are qualitative or semi-quantitative.

Wireman's Superannuation Payments

An interesting decision was given by Judge Frankland at Bradford County Court last week when the Bradford Corporation sued Robert Wilson Salter, a soldier, formerly employed as a wireman in the Corporation Electricity Department, for £12 14s. 10d. arrears of superannuation contributions.

Mr. M. Shaffner, for the Corporation, said that with the Corporation's consent Salter joined the army in July, 1940. His wages had been about £4 9s. per week and he paid 4s. 1d. a week superannuation contribution. In the army he and his wife received weekly in cash £5 5s. 3d. Under the Local Government Staffs War Service Act, 1939, it was provided that where a person serving in any superannuated capacity entered war service and his war pay was greater or not less than the remuneration he would have received in his civil capacity he was bound to contribute the same amount as previously for superannuation. Defendant contended that payment of his contributions might well stand

over until after the war, if he returned to Corporation employment. He could not afford to pay the contributions now, and payments at present gave him no benefits at all. If he were killed in action his wife would receive only back money taken out of his wages, and no compensation would be payable to her. His Honour, giving judgment for the Corporation with an order for payment at 9s. a week, said that not only was Salter's financial position very much better than before the war, but it was idle for him to suggest that his was a case calling for special consideration. He was perfectly well able to afford the comparatively trivial weekly contribution of 4s. 1d. in order to get very great future benefits.

Fatality

An inquest was held at Moulton (Lincs.) recently on Mrs. F. Cole (54) who received a fatal electric shock when she caught hold of an earth wire with her wet hand while she was washing the floor at the front entrance of the Swan Inn. Mr. F. R. C. Roberts, electrical engineer to the Spalding U.D.C., said that a cable of one of the switches had fouled a point on the earth wire. The insulation of the cable was broken and one of the live wires was bare. A joint was found in the earth wire, and he considered that if it had not been there the fuse would have blown. A verdict of " Death by misadventure " was returned.

Coal Stacking and Mixing

Wartime needs for temporary coal handling plants and the blending of fuels by mixing direct attention to such products of Mitchell Engineering, Ltd., Fengate House, Peterborough, as the " Mitro " conveyors which will stack 600 tons from one point, 16 to 23 ft. high, or load vehicles faster than ten men. These " portabelts " can easily be moved by two men, being mounted on a pair of wheels with interchangeable pneumatic tyres or flat steel treads on either swivelling or plain axles. The welded steel frame has self-oiling idlers and the conveying belt is spring-tensioned to prevent overloading. All main bearings are of the slot type and interchangeable; speed reduction is by two stages of chain and the centrifugal clutch is suitable for electric motor or petrol engine drive.

One kind of blending plant is so arranged that differing classes of fuel can be tipped from wagons into separate receiving hoppers. Each of the latter is fitted with a calibrating valve to regulate the rate of discharge to separate belt feeders, which can be driven at varying speeds, so affording complete control of delivery through a common chute to a rotary feeder that will load any form of conveyor.

For burning mixtures of low-grade fuels forced draught stokers of the mechanical chain grate type, without dumping bars so that ash may fall away freely, have been developed jointly in conjunction with the Illinois Stoker & Combustion Co., of Great Britain, Ltd.

Cambridge " Kitchen Front " Club

An interesting function took place at the Cambridge Guildhall on May 13th, when the Cambridge Branch of the Kitchen Front Club celebrated its first anniversary. During the year much hard work has been done by the service and demonstration staff of the Cambridge Electric Supply Co., Ltd. Nearly 200 demonstrations of wartime cookery have been held, some in the company's own demonstration kitchen, some in schools and others in village halls and institutes. Apart from this, nearly 1,500 personal calls were made to advise and demonstrate in consumer's own homes. During this period the membership has grown from 300 to 1,300. The Mayor of Cambridge, Sir Montagu Butler, M.A., J.P., presided, supported by the Mayoress, Mr. M. D. Bradford (chairman, Cambridge Electric Supply Co., Ltd.), Mr. P. Sydney (manager) and Miss Martin (chief demonstrator). Talks and a cooking demonstration were given, as a result of which nearly 200 new members were obtained.

Elexcel Dramatic Society

The Xcel Players (Elexcel, Ltd.) recently presented at the company's recreation headquarters the well-known comedy " George and Margaret." The players' efforts were well received and succeeded in raising funds for the Red Cross.

Cable Makers' Wages

The Joint Industrial Council for the Electrical Cable Making Industry states that there will be no cost-of-living alteration in wages on the third pay-day in June.

Trade Announcement

The new address of F. G. Wigley & Co., Ltd., is Mill Lane, Cardiff (telephone : Cardiff 977–8).

TRADE MARK APPLICATIONS

AMONG recent applications for British trade marks is the following, objections against which may be entered within a month of May 27th :—

STANENE. No. 618527. Class 17. Electric insulating materials. Standard Telephones & Cables, Ltd., Connaught House, 63, Aldwych, London, W.C.2.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following :—

Address of MANCHESTER FIBRINE CO., late of Eccles, Manchester.

Full postal address of ACME LIGHTING & ENGINEERING CO., LTD., believed to be at Bathford Mills, Somerset.

Makers of FAROTEX compound.

Post-War Problems

Federation of British Industries' Report

IN response to a request made by Sir Andrew Duncan when he was President of the Board of Trade, the Federation of British Industries has prepared a report upon the main problems which will confront industry after the war. The report has been submitted to the Federation's 182 constituent associations and unanimously adopted by the Grand Council.

It is emphasised in the introduction that the document must be considered as a preliminary one. It is an attempt to state future problems fully but not to dogmatise on the solutions. There are at present so many unknown factors that " it would be no act of statesmanship to attempt to lay down definitely the future industrial policy of the country."

Each of the various sections concludes with a " submission " and there are fourteen of these. The first is arrived at after showing that any economic planning for the restoration of prosperity to the world depends for its success on the avoidance of war, and it is to the effect that the Democracies and peace-loving nations must ensure the maintenance of a sufficient force to curb aggression.

After the war Great Britain will be a debtor, not a creditor, nation and the Federation submits that the gravity of our future task must not be underestimated. It will only be possible to preserve a reasonable standard of life by hard work and by paying as much regard to our obligations to the community as to the rights we claim from it.

Many stricken countries will need aid for their people, both from the humanitarian and economic aspects. In this there must be a widening of international collaboration with the existing wartime co-operation between the Allies as a starting point. The economic systems of the world will have to be re-created in order to achieve world prosperity. The policy of the United Kingdom must have this in view and equally world systems must be of such a nature as to facilitate our economic prosperity.

Larger Economic Groups

It may be assumed that the tendency after the war will be towards the formation of larger economic groups and it is possible to envisage a European group or groups, an East Asiatic group, and a British Empire group with, it may be hoped, the co-operation of the United States. This leads to the submission that in spite of admitted difficulties a common policy between the United Kingdom, the Empire and the United States is essential and that a system of consultation should be created.

Similarly a system of consultation with the Dominions and India should be devised for the purpose of formulating a common Empire policy for discussion with the United States at the appropriate moment. Any British Empire-U.S.A. group must maintain close touch with Russia and China with a view to economic co-operation.

One of the basic principles of reconstruction is the increasing of world purchasing power. An endeavour should be made to equate the purchasing power of the primary and secondary producing countries and to develop the more backward areas to raise the standard of living.

After briefly referring to the probable future changes in the nature of the home market, wartime expansion of industrial capacity, the location of industry, etc., the Report says that at the end of the war industry should possess the necessary financial resources to fit itself for the struggle which will lie before it. It is therefore submitted that the Government should adopt a policy with regard to taxation and contract prices which would enable adequate reserves to be built up, and should further examine in consultation with industry, the means by which terminal losses can be dealt with at the appropriate moment. The needs of industry for continuing finance for development require the most careful consideration.

The Federation recognises the need for the retention to some extent of Government wartime control over industry. Any more permanent control should be instituted in collaboration with industry itself.

The next sections of the Report deal with the position of agriculture, demobilisation and the organisation of industry. The last-named section discusses the position and nature of trade associations and calls for a consistent Government policy toward them. The view is expressed that the future organisation of industry should be decided by the industrialists, but it must be in the national interest.

Export Policy

The relative positions of trade associations and export groups are discussed and it is maintained that in future we must consider the extent to which it will be necessary for industries to act as a whole in the export markets, rather than each individual firm operating on its own, often in keen and uneconomic competition with other British firms. With regard to monetary and financial policy, it is submitted that special importance must be attached to stability of exchanges and to future policy being based primarily upon the interests of industry and commerce.

The power of the home market to consume the products of industry in the post-war period is considered to be an essential element in reconstruction. The Government should consider how this power can be maintained or developed both as regards consumer goods and capital equipment and should take industry into the fullest consultation on the problems involved.

Finally, it is submitted that the consideration of the main problems of policy raised in the Report and knowledge of the Government's views on them are an essential first step in reconstruction, but must be followed by consideration of many more problems of vital importance to industry.

It is noted that the F.B.I. does not deal with labour questions which fall within the scope of the British Employers' Confederation, which will no doubt at the appropriate moment formulate its own views which will be complementary to those of the F.B.I.

RECENT INTRODUCTIONS

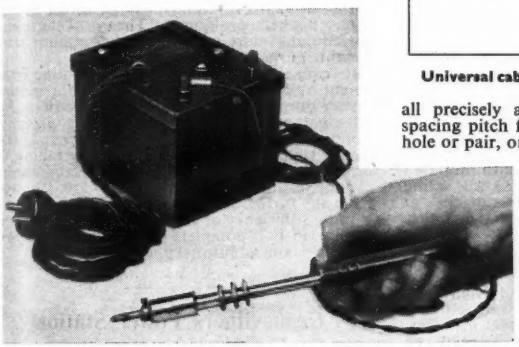
Notes on New Electrical and Allied Products

Lightweight Soldering Iron

SPECIFICATION details are announced by ELECTRICAL & AUTO PRODUCTS (1931), LTD., Burton's Building, 73a, Oxford Road, Manchester, 1, of a new low-voltage soldering iron that has been specially designed for delicate work, such as is done in the instrument making trade.

This "Runbaken" product weighs 5 oz. and is chromium finished. The copper bit is both adjustable and detachable, several types being available. The heating element is loaded to 30 W and cooling is assisted by the fitting of radiating fins for the purpose of dissipating heat from the handle, which is made of bakelite or similar material.

The iron is operated at 12 V through a step-down transformer, which is fitted with a pilot light, under which conditions the element may be expected to last a long time. Several models of transformer can be furnished to energise from one to fifty irons.

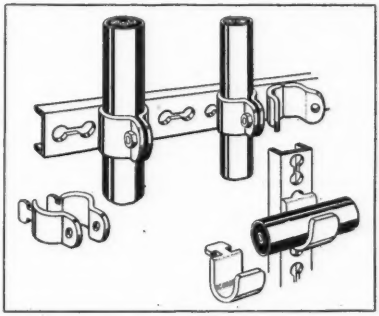


"Runbaken" lightweight soldering iron for instrument makers

Cable Hangers

Mild-steel cable hangers and racks for cables of all sizes in multi-ways are available in great variety, but through-bolting from behind can be decidedly awkward, while appreciable space may be wasted between adjacent clamps and by the projection cleats, especially when many cables have to be accommodated in restricted space. All such inconveniences are completely avoided by the latest patented designs, more adaptable than before, introduced by ROBERT MCGREGOR & Co., Alpine Steel Works, East Molesey, Surrey.

Although particularly applicable to the vertical support of cables, or conduit and pipes, the fixing bars may be clamp-bolted to girder flanges with facility, or attached in the usual ways to walls, ceilings and floors, in trenches, or built up to form posts and frames. In the fixing bars, preferably of mild-steel channel section and conveniently cut into desired lengths, is formed a series of holes with a slot connecting each pair in dumb-bell fashion. Since they are all precisely alike, of uniform diameter and spacing pitch for interchangeability, any single hole or pair, or any two holes of adjacent pairs, may be selected to clamp a cable closely to its neighbours at any desired multiple of the hole pitch, which is always 1 in.



Universal cable-supporting clamps and hangers

The clamps are made in two halves, which are separately inserted in the bar-slot, moved longitudinally into the hole and then half-turned so that their tee-shaped lugs prevent their withdrawal. The clamp is secured by a bolt in front of the cable, so that any one may be released or replaced individually without disturbing the remainder; it is shaped to fit the cable and is self-aligning without its edges biting into the sheath. Various sizes of clamps can be adapted to support cables of different diameter in the standardised holes along the same fixing bar, or slot hangers may be used in place of bolted clamps, each part of which is free to rock to an appreciable extent to facilitate the entry of the cable.

E.I.B.A. Donations

THE Electrical Industries Benevolent Association gratefully acknowledges the receipt, during the first four months of the year, of several gifts of over £50. It will help the Association's work if subscriptions are paid as early as possible in the year so that the flow of income is equalised, with that of expenditure, throughout the twelve months. At present the bulk of income is received towards the end of the year. Moreover, by not waiting for reminders, subscribers will save the Association postage and clerical work.

ELECTRICITY SUPPLY

Dalmarnock Fuel Supplies.

Glasgow.—USE OF COKE BREEZE.—A letter from the Under Secretary for Mines which came before the Electricity Committee recently suggested that in view of difficulties in obtaining satisfactory deliveries of fuel the Corporation should consider favourably the use of a proportion of coke breeze at Dalmarnock generating station. The general manager reported that he had been in consultation with the manager of the Gas Department and had arranged to take delivery, during the ensuing twelve months, of approximately 20,000 tons of breeze, to be mixed with the ordinary fuel supplies and utilised at Dalmarnock. The Committee agreed to this being done.

London.—J.E.A.'s BORROWING POWERS.—It was reported at yesterday's meeting that no objections had been deposited against the London and Home Counties Joint Electricity Authority (Increase of Borrowing Powers) Draft Provisional Order.

RECTIFYING PLANT.—In the Teddington area, where the supply is DC (and under present conditions it is not possible to change to AC), the J.E.A. proposes to install balancer bulbs of 200 kW output at a substation as the DC load in the district served is about equal to the output of the line bulbs. The installation of balancer bulbs will have the additional advantage of dealing with " out-of-balance " in the district. The estimated cost is £4,177. It is also proposed to install, at an estimated cost of £3,801, a line set of rectifying plant of 250 kW capacity at another substation where one of the rotary convertors is fifteen years old.

Marple.—OVERHEAD-LINE INQUIRY.—A public inquiry was held at Marple recently into a proposal by the Trent Valley and High Peak Electricity Co., Ltd., to erect an overhead line. Mr. E. J. Cook, engineer and resident manager, said that an overhead line would cost £130 and an underground cable £350. Objectors claimed that an overhead line would spoil the amenities of the district. The result of the inquiry will be announced in due course.

Portland.—OVERHEAD LINE.—The U.D.C. Electricity Committee is to provide an overhead line at a cost of £120 for a supply to lime kilns.

Wellingborough.—SUBSTATION.—The Rural District Council has passed plans for the erection of a substation for the Northampton Electric Light & Power Co.

Overseas

Australia.—POWER STATION FIRES.—Our Perth correspondent reports that Busselton (Western Australia) experienced a total black-out recently through the municipal power house being destroyed by fire. When a large tank of oil collapsed the burning liquid surrounded the building, almost trapping a number of the firemen. Damage is estimated at £15,000. The cause of the fire is unknown. Other recent fires include one at the electricity undertaking premises at Ungarie (New South Wales) and at the Birchep Electricity Supply Co.'s premises at Birchep (Victoria). At Ungarie a temporary service was established within twelve hours. At Birchep, £3,000 worth of damage was done.

SHORTAGE OF FUEL.—The Northam (W.A.) Municipal Council is confronted with a serious problem, having less than six weeks' supply of firewood on hand at its electric power works (wood is burned in many of the smaller Australian power stations to a large extent). It is hoped that the Government will be able to take steps to relieve the labour shortage which is responsible for the scarcity of fuel.

Restrictions in Eire.

Eire.—DRASTIC ELECTRICITY RESTRICTIONS.—Our Dublin correspondent reports that on May 18th the Electricity Supply Board gave twenty-four hours' notice of a severe rationing scheme, which coincided with a new and greater curtailment of gas supplies. The use of electric fires, heaters, tubular heaters, and all other forms of space or room heating, direct or indirect, has been prohibited. The use of electricity for cooking must not exceed the amount used for this purpose in the corresponding period of last year; electricity used for water heating must be cut by 50 per cent. and electricity for motive power purposes by 10 per cent. Electricity for all other purposes, including lighting, ironing, radio, etc., must be cut by 25 per cent. The Board states that consumers who, by failing to economise, cause hardship to the community cannot justifiably complain if they are debarred from any further supply without notice. If there is not a sufficiency of electricity for industry the result will be a complete dislocation of national economy, and additional unemployment.

Gennevilliers Power Station

AN important feature of the industrial area of Gennevilliers near Argenteuil on the northern outskirts of Paris, which received a second visit from the R.A.F. last Friday night, is the power station of the Union D'Electricité. This station, which an unconfirmed Vichy report states to have been destroyed, was put into commission just twenty years ago as part of a reorganisation scheme for the metropolitan area and was of advanced design for that period. The initial installation consisted of five Zoelly-type 40,000-kW, 1,500-RPM, 6-kV turbo-alternators and two 3,000-kW, 3,000-RPM, 3-kV house sets. Steam at 355 lb. per sq. in. and 700 deg. F. was supplied by twenty Babcock & Wilcox and five Stirling boilers with normal evaporative capacities of 88,000 and 130,000 lb. per hr. All auxiliaries of 50 HP and over were wound for 3,000-V. The voltage of generation was stepped up to 60 kV and power was transmitted by cables each made up of three single-phase cables controlled by circuit breakers with a rupturing capacity of 600,000 kVA. The station was designed for an ultimate capacity of 320,000 kW and for connection to a hydro-electric station not then constructed at Eguzon on the River Creuse.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Brush Electrical Engineering Co., Ltd., reports a trading profit for 1941 of £184,484, an increase of £56,864 as compared with 1940. The net profit shows an increase of £36,157 at £88,701, and this is struck after charging debenture and loan interest, reserve for depreciation and renewals and other charges, including £28,064 war risk insurance. As already announced, the ordinary dividend is resumed at 6 per cent., less tax, for the year, the first since 1930. General reserve receives £50,000, £16,501 is written off patents and goodwill, and after deducting £3,611 A.R.P. expenditure and £4,353 war damage insurance, and crediting £11,039 brought in, the balance carried forward is £6,601.

Crompton Parkinson, Ltd., have declared the following dividends, all subject to tax:—At the rate of 4 per cent. on the 8 per cent. first preference stock in respect of the six months ended March 31st; at the rate of 3 per cent. on the 6 per cent. second preference stock in respect of the six months ended March 31st; and an interim dividend at the rate of 7½ per cent. actual on the ordinary and "A" ordinary stock in respect of the current financial year ending September 30th.

Newman Industries, Ltd., report a net profit for 1941 of £43,300, as compared with £46,647 for 1940, to which is added £12,104 brought in, making £55,404 available. Of this, income tax reserve receives £7,500, redeemable preference share redemption reserve £2,000, and war damage contribution reserve £500. It is proposed to pay a dividend on the ordinary shares of 20 per cent. actual, less tax. This is at the same rate as for the previous year but is payable on a double capital of £130,000. The balance carried forward is £10,044.

Parkinson & Cowan, Ltd., report a net profit for 1941 of £45,395, as compared with £55,843 for the preceding year, the latter figure including a surplus on the sale of investments of £45,824. It is proposed to pay a first and final dividend on the ordinary shares of 5 per cent., less tax (against 3 per cent.).

Edmundsons Electricity Corporation, Ltd., has recommended the payment of a final dividend on the ordinary stock of 3½ per cent. actual, less tax, making 6 per cent. for the year (unchanged).

The Craigpark Electric Cable Co., Ltd., is paying on June 30th a dividend of 24 per cent. actual on the 6 per cent. cumulative preference shares. This covers the four years to March 31st last.

The Electrical Finance & Securities Co., Ltd., is maintaining its dividend for the year at 12½ per cent. by a final payment of 6 per cent. and a bonus of 2½ per cent.

The Anglo-Portuguese Telephone Co. Ltd., has announced its final dividend at 5 per cent., making 8 per cent. for the year (same). The "A" ordinary dividend for the year is maintained at 8 per cent.

The Great Northern Telegraph Co.—The accounts for 1941, which are not complete owing to the lack of reports from abroad, show a gross income of 4,720,000 kr. and expenditure of 4,300,000 kr. As in the previous year no dividend is being paid.

The Metropolitan Electric Cable & Construction Co., Ltd., is paying a final dividend of 5 per cent., making 7½ per cent. for the year (same).

B.E.T. Electric Supply Co., Ltd., has announced a first and final dividend of 4 per cent. (unchanged).

The Bridgwater & District Electric Supply & Traction Co., Ltd. is again paying a first and final dividend of 6 per cent.

Walsall Conduits, Ltd., has declared a final dividend of 35 per cent., maintaining the distribution for the year at 55 per cent.

Stream-Line Filters, Ltd., have declared a further interim dividend of 7 per cent. (same), making 10 per cent. (same).

Dictograph Telephones, Ltd., have declared an interim dividend of 4 per cent.

R. A. Lister & Co., Ltd., are maintaining the interim ordinary dividend at 5 per cent., less tax.

New Companies

Rockman Engineering Co., Ltd.—Private company. Registered May 22nd. Capital, £200. Objects: To carry on the business of manufacturers of, and dealers in, electric soldering irons, dynamos, motors, armatures, magnetos, batteries, insulators, stoves, cookers, electrical and other plant and supplies, etc. Directors: J. J. Lock, 259, Burnage Lane, Levenshulme, Manchester 19, and A. I. Rochmann, "Hillcrest," Leicester Road, Salford 7. Registered office: 48–50, Mosley Street, Manchester 2.

Harris Electrical, Ltd.—Private company. Registered May 21st. Capital, £1,500. Objects: To acquire the business of an electrical and radio contractor and dealer carried on by T. Archibald Harris at Hackney. Directors: T. Archibald Harris, 27, Algers Road, Loughton, Essex, T. Arthur Harris, 68, Greenway Avenue, Walthamstow, and S. C. Harris, 27, Algers Road, Loughton. Registered office: 52, Lower Clapton Road, E.5.

Lancashire Electro Plating Co., Ltd.—Private company. Registered May 6th. Capital, £1,000. Objects: To carry on the business of electro, chromium, nickel and silver platers, gilders, lacquerers, polishers and metal depositors, mechanical and electrical engineers, etc. Directors: H. M. Freckleton, "Lincombe," Torkington Road, Hazel Grove, Cheshire, and W. J. Baker, 19, Headlands Drive, Prestwich, Manchester, both engineers, and directors of Manchester Diecasting Co., Ltd. Registered office: Portugal Works, Poland Street, Manchester.

Silent Transport, Ltd.—Private company. Registered May 21st. Capital, £100. Objects:

To carry on the business of manufacturers of and dealers in electrically propelled vehicles, garage proprietors, motor, electrical and general engineers, etc. Subscribers: H. Reynolds and H. A. Southwell, both of 7, Arundel Street, W.C.2. Solicitors: Reynolds, Sons & Gorst, 7, Arundel Street, W.C.2.

Jove, Ltd.—Private company. Registered May 20th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in electrical appliances and equipment, tools, fittings, etc. Directors: J. Weisz and Mrs. H. Weisz, both of 194, Lordship Road, N.16. Registered office: 16–17, Devonshire Square, E.C.2.

Companies' Returns

Statements of Capital

Bullers, Ltd.—Capital, £400,000 in 20,000 5 per cent. cumulative preference shares of £10 of which 15,000 have been converted into preference stock; and 20,000 ordinary shares of £10, of which 15,593 have been converted into ordinary stock. Return dated January 2nd. £150,000 preference and £155,930 ordinary stock taken up. £150,070 paid; £155,860 considered as paid. Mortgages and charges: £143,557.

Mann, Egerton & Co., Ltd.—Capital, £370,925 1s. in 250,000 preference shares of £1 and 2,418,501 ordinary shares of 1s. Return dated January 12th. 210,415 preference and 710,721 ordinary shares taken up. £198,920 1s. paid on 191,434 preference and 149,721 ordinary shares. £47,031 considered as paid on 18,981 preference and 561,000 ordinary shares. Mortgages and charges: £42,818.

Julius Sax & Co., Ltd.—Capital, £10,000 in 3,000 7½ per cent. preference shares of £1 and 35,000 ordinary shares of 4s. Return dated January 13th. 2,650 preference and 18,000 ordinary shares taken up. £5,051 paid on 2,650 preference and 12,005 ordinary shares. £1,199 considered as paid on 5,995 ordinary shares. Mortgages and charges: Nil.

T. M. C. - Harwell (Sales), Ltd.—Capital, £15,000 in £1 shares. Return dated December 5th, 1941. 10,000 shares taken up. £10,000 paid. Mortgages and charges: Nil.

Lucas Batteries, Ltd.—Capital, £20,000 in 20,000 shares of £1 each. Return dated January 12th. All shares taken up. £20,000 paid. Mortgages and charges: Nil.

Mullard Wireless Service Co., Ltd.—Capital £50,100 in 50,000 "A" and 100 "B" shares of £1 each. Return dated January 13th. All shares taken up. £49,300 paid. £800 considered as paid. Mortgages and charges: Nil.

Mortgages and Charges

Associated Electronic Engineers, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated May 12th, 1942, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Wembley Electrical Appliances, Ltd.—Debenture, charged on the company's assets, present and future, including uncalled capital, dated May 11th, 1942, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

Underwood (Electric), Ltd.—Assignment on May 7th, 1942, of proceeds of certain contracts, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £3,500.

Bankruptcies

B. J. Wainwright, electrician, Hillcrest Gardens, Dollis Hill Lane, Cricklewood, lately trading as The Wells Road Garage and Wainwright Neon Displays.—The first meeting of creditors was held on May 27th at London Bankruptcy Buildings. Debtor stated that he began business on his own account in 1933 and attributed his insolvency to lack of working capital and loss of trade through war conditions. The accounts show total liabilities £1,069, of which £938 is expected to rank for dividend, against net assets valued at £213. A resolution was passed for Mr. P. Phillips, accountant, to administer the estate as trustee.

F. Johnson, 115, Ullswater Crescent, Kingston Vale, electrical engineer, lately 36, St. Phillips Avenue, Worcester Park, and 36, Westwood Road, Barnes, Surrey.—The public examination was held recently at the Guildhall, Kingston-upon-Thames, Surrey. The debtor had returned a statement of affairs showing a deficiency of £599. He attributed his failure to certain litigation, heavy expenses incurred in connection with protracted illness of his family and to the fact that he had lived in excess of his income. The hearing was adjourned.

L. Dixon, journeyman electrician, 209, Hall Street, Stockport, formerly carrying on business at 165, Great Portwood Street, Stockport, as an electrician.—First and final dividend of 1s. 2¼d. in the £, payable June 16th at 20, Byrom Street, Manchester, 3.

L. C. Rowse, radio and electrical engineer, 20, Western Place, Penryn, Cornwall, formerly carrying on business at 60, Lower Market Street, Penryn.—Last day for receiving proofs for dividend June 12th. Trustee, Mr. C. Hancock, 12, Princes Street, Truro, Official Receiver.

L. R. Maddock, electrical contractor, 7c, Block A, The Temple, 24, Dale Street, Liverpool.—Trustee, Mr. P. S. Booth, 5, Rumford Place, Chapel Street, Liverpool, appointed May 20th.

F. L. Hawdon (Locksley & Co.), electrical and radio engineer, 27A, Sale Street, London, W.2.—First and final dividend of 19s. 6d. in the £, payable any day (except Saturday) at Bankruptcy Buildings, Carey Street, London, W.C.2.

W. R. Marchant (Marchant & Co.), electrical contractor, 81, Sandgate Road, Folkestone.—First and final dividend of 11d in the £ payable June 23rd at Bank Chambers, Ashford, Kent.

Liquidations

Wilkes Radios (Urmston), Ltd.—Meeting, pursuant to Section 245 of the Companies Act, 1929, on June 26th at 46, Singleton Road, Kersal, Salford, 7, to receive an account of the winding-up by the liquidator, Mr. C. Green.

STOCKS AND SHARES

TUESDAY EVENING.

AWAITING the signal for the start of the next Government campaign towards securing subscriptions to the war effort, Stock Exchange markets maintain a steady front so far as prices are concerned, and they attract a bread-and-butter business on most days of the week.

Discussion has arisen as to how the Stock Exchange, like Lloyds, the banks, insurance, trust and other financial bodies, could utilise the 46 hours which the Government propose to regard as the minimum working time per week. One of the suggestions unofficially advanced in the Stock Exchange for making the best use of time at present unoccupied is that members and clerks who are not serving in the Forces should be given a certain amount of light mechanical work to perform. Practically everybody who is not serving in the Forces has other obligations of national work, but it is readily recognised that, if the Government should call upon the City for further man-power, every effort will be made to meet the requirements.

Transport Co-ordination

The Labour Party at its recent conference passed a resolution urging that the Government should co-ordinate the road, rail and inland waterways systems of transport, and bring them under national ownership. The mover of the resolution said they were not asking for an immediate establishment of a national board of control, as this might hinder the national effort in the position which existed to-day. Evidence is constantly afforded of the desire of the Labour Party to nationalise transport and probably this is one reason why investment remains shy of employing money to any substantial extent in the stocks of Home Railway companies. Prices keep steady, and the money policy of the Government has the effect of maintaining quotations for Home Railway gilt-edged stocks at a comparatively high level. Interest in the junior securities awakes, however, very spasmodically. When an occasional bout of activity enlivens the market, it seldom lasts for more than a week or two at a time.

Cable and Wireless

It was on June 6th last year that Cable and Wireless declared the dividend on its ordinary stock for the year 1940. Presumably, therefore, the announcement in respect of 1941 will be out in the course of this week. Optimism prevailing in connection with the possibility of an increase upon the last-paid 4 per cent. dividend on the ordinary stock has given way to more cautious counsels, and the market expectation of 4 per cent. is now generally accepted. Prices of the preference and of the ordinary stocks are maintained at 98 and 58 respectively, business in both securities proceeding on jog-trot lines. If the 4 per cent. dividend is repeated, the ordinary stock will look to be worth its present figure, possibly a few points more, while the preference at 98 has attractions as being a good mixer with securities that return a lower rate of interest.

" Emmies "

Lively dealings in the 10s. shares of Electric and Musical Industries have resulted in a rise in the price to 16s. 3d. Shares have changed hands up to 16s. 3d. On the last declared dividend of 6 per cent., the yield at 16s. is no more than 3¾ per cent. on the money, but the recent buying has been of an unusually substantial character and the purchasers are understood to be taking the post-war view of the company's prospects. Having regard to the amount of work which will be available for the E.M.I. Co. in the way of replacements of radio and gramophone sets after the war, it is claimed that the present price, however slender a yield on the money it may afford, will prove to be justified.

Price Fluctuations

Indian industrial shares continue the recovery which was started by announcement of a 7 per cent. tax-free dividend for the year by the Calcutta Electric Supply Co. The shares of the latter, at 23s. 9d. ex dividend, show 1/16 rise, and Madras Electrics have risen 3s. 9d. to 18s. 9d. Calcutta Trams at 13s. 9d. are half-a-crown up; much of the recent apprehension felt in regard to Indian industrials is now subsiding.

Business was marked the other day in Tokyo Electric 6 per cent. bonds at 10½; the nominal price of 11 shows a fall of 1½. The Great Northern Telegraph Co. is paying no dividend to shareholders in this country. The price of the shares is unchanged at 14½, and there are buyers prepared to pay that price, or thereabouts. Although no dividend is looked for during the period of the war, it is generally assumed that the company has assets in British securities worth ten or twelve pounds per share. According to report, by the way, Great Northern Telegraph shares are held largely by the Danish Royal Family.

A number of small improvements have occurred in the list of equipment and manufacturing shares. Callenders at 73s. 9d. are 1/16 up; Siemens at 27s. have gained 9d.; British Aluminium at 43s. 9d. and Associated Electrical ordinary at 45s. 9d. are also 9d. higher. Brush ordinary revolve around 5s. 6d.; the preference are 21s. bid, and the option certificates are 2s. 6d. a middle.

Electrical Finance & Securities

The Electrical Finance & Securities Co., in declaring a final dividend of 6 per cent. and

(*Continued on page* 741)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939–40	Dividend 1940–41	Middle Price June 2	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	53/9	..	4 13 0
British Power and Light	6	6	28/6	..	4 4 3
City of London	7	7	27/6	..	5 1 9
Clyde Valley	8	8	40/–	..	4 0 0
County of London	8	8	37/6	..	4 5 6
Edmundson's:					
7% Pref.	7	7	35/–	..	4 0 0
Ord.	6	6	28/6	..	4 4 3
Elec. Dis. Yorkshire	9	9	42/–	..	4 5 9
Elec. Fin. and Securities	12½	12½	48/9	..	5 2 6
Elec. Supply Corporation	10	10	45/–	..	4 9 0
Isle of Thanet	2	Nil	11/3	..	—
Lancs. Light and Power	7½	7½	35/–	..	4 5 9
Llanelly Elec.	5½	5½	22/6	..	4 17 9
Lond. Assoc. Electric	4½	4	18/9	..	4 5 10
London Electric	6	6	25/–	..	4 16 0
London Power Red. Deb.	5	5	104½	..	4 15 7
Metropolitan E.S.	8	8	36/3	..	4 8 6
Midland Counties	8	8	39/6	..	4 1 0
Mid. Elec. Power	9	9	42/–	..	4 5 9
Newcastle Elec.	7	7	27/6	..	5 1 10
North Eastern Elec. Ordinary	7	7	31/3	..	4 9 7
7% Pref.	7	7	34/6	..	4 1 2
Northampton	10	10	46/3	..	4 6 7
Notting Hill 6% Pref. (£10)	6	6	9	..	—
Northmet Power:					
Ordinary	7	7	35/9	..	3 18 4
6% Pref.	6	6	32/6	..	3 13 10
Richmond Elec.	6	6	25/–	..	4 16 0
Scottish Power	8	8	39/6	..	4 1 0
Southern Areas	5	5	21/3	..	4 14 0
South London	7	7	26/–	..	5 7 8
West Devon	5	5	21/3	..	4 14 0
West Glos.	4½	3½	20/–	..	3 10 0
Yorkshire Elec.	8	8	40/–	..	4 0 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	4/6	+3d.	—
Calcutta Elec.	7*	7*	23/9xd	+1/6	5 18 0
Cawnpore Elec.	10	10	25/–	..	8 0 0
East African Power	7	7	27/–	..	5 3 8
Jerusalem Elec.	7	5	18/9	..	5 6 8
Kalgoorlie (10/–)	7½	7½	7/6	..	10 0 0
Madras Elec.	6*	4*	18/9	+1/6	4 5 4
Montreal Power	1½	1½	23½	..	6 7 6
Palestine Elec. "A"	Nil	Nil	18/9	..	—
Perak Hydro-elec.	6	7	5/–	..	—
Shawinigan Power	83cts.	90cts.	14½	..	—
Tokyo Elec. 6%	6	6	11	–1½	—
Victoria Falls Power	15	15	73/9	+1/6	4 1 4
Whitehall Inv. Pref.	7½	5	15/9	..	6 7 0

Company	Dividend 1939–40	Dividend 1940–41	Middle Price June 2	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1950–70	5	5	110½	..	4 10 6
1955–75	5	5	115	..	4 7 0
1951–73	4½	4½	109	..	4 2 7
1963–93	3½	3½	103½	..	3 7 8
1974–94	3½	3½	99	..	3 5 8
London Elec. Trans. Ltd.	2½	2½	95	..	2 12 8
London & Home Counties 1955–75	4½	4½	112	..	4 0 4
Lond. Pass. Trans.:					
A	4½	4½	119½	..	3 15 4
B	5	5	116½	..	4 5 10
C	3	2⅞	40½	..	7 2 0
West Midlands J.E.A. 1948–68	5	5	110	..	4 11 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	112½	..	5 6 8
Def.	1½	1½	26	..	5 15 5
Anglo-Portuguese	8	8	17/6	+½	9 2 10
Cable & Wireless:					
5½ Pref.	5½	5½	98	..	5 11 10
Ord.	4	4	58	..	6 13 0
Canadian Marconi $1	Nil	4cts.	5/–	..	3 7 0
Globe Tel. & Tel.:					
Ord.	8½*	8½*	27/6	..	—
Pref.	6	6	27/6	..	4 7 5
Great Northern Tel.: (£10)	20	20	14½	..	—
Inter. Tel. & Tel.	Nil	Nil	3½	..	—
Marconi-Marine	7½	7½	28/9	..	5 4 4
Oriental Tel. Ord.	11½*	16	45/–	..	7 2 3
Telephone Props.	6	Nil	8/9	..	—
Tele. Rentals (5/–)	10	10	8/9	..	5 14 1
Traction and Transport					
Anglo Arg. Trans.:					
First Pref. (£5)	Nil	Nil	5/–	..	—
4% Inc.	Nil	Nil	11½	+1	—
Brit. Elec. Traction:					
Def. Ord.	45	45	925	..	4 17 3
Pref. Ord.	8	8	180	..	4 9 0
Bristol Trams	8	10	46/3	..	4 6 4
Brazil Traction	$1	50c	13½xd	..	—
Calcutta Trams	8	5½	13/9	+½	8 0 0
Cape Elec. Trams	5	5	19/–	..	5 5 3
Lancs Transport	10	10	43/9	..	4 11 4
Mexican Light:					
1st Bonds	5	5	82½	..	6 1 3
Rio 5% Bonds	5	5	97½	..	5 2 8
Southern Rly.:					
5% Prefd.	5	5	64½	..	7 15 0
5% Pref.	5	5	109½	–1	4 11 4
T. Tilling	10	10	50/–	..	4 0 0
Tilling & B.A.	7*	6½*	55/–	..	2 7 3
West Riding	10	10	39/6	..	5 1 3

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend 1939–40	Dividend 1940–41	Middle Price June 2	Rise or Fall	Yield p.c.
Equipment and Manufacturing					£ s. d.
Aron Elec. Ord. ..	Nil	7½	24/–	..	6 5 0
Assoc. Elec.:					
Ord.	10	10	45/9	+9d.	4 7 6
Pref.	8	8	40/–	+⅛	4 0 0
Automatic Tel.& El.	12½	12½	52/–	..	4 16 3
Babcock & Wilcox .	11	11	43/3	+6d.	5 1 6
British Aluminium .	10	10	43/9	+9d.	4 11 4
British Insul. Ord. .	20	20	93/9	..	4 5 6
British Thermostat (5/–)	18½	18½	16/3	..	5 13 10
British Vac. Cleaner (5/–)	12½	10	11/3	..	4 9 0
Brush Ord. (5/–) ..	Nil	6	5/6	..	5 9 3
Callender's	15	15	73/9	+⅛	4 1 9
Chloride Elec. Storage	15	15	73/9	..	4 1 4
Cole, E. K. (5/–) ..	Nil	7	11/3	+3d.	3 2 2
Consolidated Signal	17	17	72/6	..	4 3 8
Crabtree (10/–) ..	17½	17½	29/6	..	5 18 8
Crompton Parkinson Ord. (5/–) ..	30	20	22/6	..	4 9 0
E.M.I. (10/–) ..	Nil	6	16/–	+1/–	3 15 0
Electric Construction	10	10	34/6	..	5 16 0
Enfield Cable Ord. .	12½	12½	55/–	..	4 11 0
Elecl. Switchgear (10/–)	10	10	20/–	..	5 0 0
English Electric ..	10	10	42/–	..	4 15 3
Ensign Lamps (5/–)	25	25	16/3	..	7 13 10
Ericsson Tel. (5/–)..	22*	20*	41/3	..	2 8 6
Ever Ready (5/–) ..	40	40	32/3	+3d.	6 4 0
Falk Stadelmann ..	7	7½	22/–	..	6 16 4
Ferranti Pref. ..	7	7	27/6	..	5 1 10
G.E.C.:					
Pref.	6½	6½	35/–	..	3 14 2
Ord.	20	17½	83/9	..	4 3 9
Greenwood & Batley	15	13	30/–	+6d.	8 13 4
Hall Telephone (10/–)	10	12½	20/–	..	6 5 0
Henley's (5/–) ..	20	20	22/6	..	4 9 1
4½% Pref. ..	4½	4½	22/6	..	4 0 0
Hopkinsons ..	15	15	48/9	..	6 3 0
India Rubber Pref.	5½	5½	21/3	..	5 3 6
Intl. Combustion ..	32½	30	107/6	..	5 11 6
Johnson & Phillips	15	15	60/–	..	5 0 0
Lancashire Dynamo	20	20	67/–	..	5 19 4
Laurence, Scott (5/–)	15	12½	9/–	..	6 19 0
London Elec. Wire.	7½	7½	28/3	..	5 6 2
Lucas, J.	15	15	65/–	..	4 12 4
Mather & Platt ..	10	10	39/6	..	5 1 3
Metropolitan Elec. Cable Pref. ..	5½	5½	21/3	..	5 3 6
Murex	20	20	91/3	–⅛	4 7 9
Pye Deferred (5/–).	25	25	15/–	..	8 6 8
Revo (10/–) ..	5	20	28/9	..	6 19 2
Reyrolle	12½	12½	57/6	..	4 7 0
Siemens Ord. ..	7½	7½	27/–	+9d.	5 11 3
Smith, S. (1/–) ..	50	37½	7/–	..	5 7 2
Strand Elec. (5/–)..	2	4	3/6	..	5 14 4
Switchgear & Cowand (5/–) ..	15	10	10/–	..	5 0 0
T.C.C. (10/–) ..	Nil	5	12/6	..	4 0 0
T.C. & M.	10	10	41/3	..	4 17 0
Telephone Mfg. (5/–)	9	9	9/3	..	4 17 3
Tube Investments .	23¾	20	82/–	..	4 17 7
Vactric (5/–) ..	Nil	Nil	6/–	..	—
Vickers (10/–) ..	10	10	16/6	–3d.	6 1 3
Ward & Goldstone (5/–)	20	20	18/6	..	5 8 3
Westinghouse Brake	10	10	47/6	..	4 4 2
Walsall Conduits (4/–)	55	55	33/9	..	6 10 4
West, Allen (5/–) ..	7½	7½	5/9	..	6 10 5

*Dividends are paid free of Income Tax.

Stocks and Shares (*Concluded from page* 739)

bonus of 2½ per cent., makes up the year's distribution to 12½ per cent., which is the same as it has been annually since 1929. The company's principal investments are in the Colne Valley Electric Supply Co., the Northwood Electric Light & Power Co., the Lothians Electric Power Co. and the Boston & District Electric Supply Co. Of these, the largest is the Lothians Company, whose area of supply covers over 700 square miles, embracing many of the best known Scottish coal mines and industrial undertakings. The company has forged steadily ahead for years past and the shares are amongst the best-held in their own particular group.

Watford Electric

The Watford Electric and Manufacturing Co., returning a profit for 1941 of £41,000 against £31,000 in the previous year, announces a dividend on the ordinary shares of 15 per cent. This is the same as the 1940 distribution. There is not much market in these 2s. shares; at the nominal price of 3s. 6d. the yield comes to 8½ per cent. on the money. At the moment the shares are easier to sell than to buy.

Investment Adventure

Any suggestion that preference shares should be sold on account of present high prices is countered with the objection that, if they were realised, what would the holder do with the money? This question is particularly difficult to answer at the present time, when the cheap money policy of the Government has resulted in the establishment of what appears to be an artificial state of conditions which govern the quotations for investment securities. To exchange from these preference shares into the ordinary shares of the same companies may possibly be regarded as an adventure from investment to speculation, especially in view of the Government's proposals to ration fuel. If carried out, the latter would probably have an unfavourable effect upon the profits of the companies. It might be reflected, of course, in the dividends distributed on ordinary share capital. Stock Exchange opinion is that even if there should be a reduction in the dividends, this would be no more than a temporary matter.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1940

11733. "Static discharge devices." United Air Lines Transport Corporation. May 10th, 1940. (545007.)

12301. "Electricity conductors." L. G. Morten and J. F. O'Brien. September 27th, 1939. (545009.)

12813. "Photo-electric controlled machines." A. P. Tompkin and A. Hearn. October 9th, 1940. (545010.)

13731. "Driving arrangements for lifts, hoists and the like." Express Lift Co., Ltd., and W. A. Dixie. September 2nd, 1940. (544972.)

13970. "Television apparatus." J. L. Baird. September 7th, 1940. (545078.)

15898. "Reception of frequency- or phase-modulated waves." I. J. P. James and J. E. Best. October 31st, 1940. (544945.)

15954. "Thermionic valves." Mullard Radio Valve Co., Ltd., and A. J. Van Hoorn. October 31st, 1940. (544951.)

16046. "Method of and apparatus for forming rods, tubes, and like articles by extrusion." British Thomson-Houston Co., Ltd. November 4th, 1939. (544974.)

16089. "Electrical systems for the transmission and reception of intelligence." Standard Telephones & Cables, Ltd., and W. A. Beatty. November 5th, 1940. (544975.)

16210. "X-ray timing apparatus." Ferranti, Ltd. (Ferranti Electric, Ltd.). November 7th, 1940. (545049.)

16211. "Electrical switches operated by a glow discharge." General Electric Co., Ltd., W. J. Jennett and S. H. Noble. November 7th, 1940. (545050.)

16240. "Alternating-current electromagnets." British Thomson-Houston Co., Ltd. November 8th, 1939. (545087.)

16274. "Automatic telephone system." Leich Electric Co. November 30th, 1939. (544954.)

16312. "Spark distributors for magneto-electric machines." British Thomson-Houston Co., Ltd., and G. E. Fardon. November 11th, 1940. (544955.)

17055. "Multi-unit antenna communication systems." Standard Telephones & Cables, Ltd. February 17th, 1940. (545052.)

17360. "Centring and supporting arrangement for shaft packings and the like." British Thomson-Houston Co., Ltd. December 6th, 1939. (545093.)

17488. "Containers, chiefly designed for electric incandescent lamps and like articles." J. Hendry. December 10th, 1940. (544958.)

17577. "Generators of electrical oscillations." D. Cooke. December 11th, 1940. (544959.)

17599. "Steam superheating apparatus equipped with desuperheating means." Superheater Co., Ltd., and J. E. Wood. December 12th, 1940. (Addition to 523014.) (544960.)

17659. "Excitation control of alternating-current generators." Igranic Electric Co., Ltd. December 14th, 1939. (545055.)

17856. "Electric heaters for vehicle and other windscreens or windows." C. R. Foster. December 18th, 1940. (545019.)

17934. "Electric switches with push-button or plunger actuation." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and W. E. Hill. December 20th, 1940. (544987.)

17947. "Telegraph printer." Creed & Co., Ltd. (Western Union Telegraph Co.). December 20th, 1940. (544988.)

18045. "Gas-blast electric circuit-breakers." British Thomson-Houston Co., Ltd. December 22nd, 1939. (544989.)

18218. "Electric connector means." J. F. O'Brien. December 30th, 1940. (Convention date not granted.) (544961.)

1941

128. "Electric protective devices." British Thomson-Houston Co., Ltd. January 3rd, 1940. (545059.)

382. "Spring operating mechanisms for electric switches or circuit-breakers." British Thomson-Houston Co., Ltd. January 10th, 1940. (545061.)

475. "Electric motor-control systems." British Thomson-Houston Co., Ltd. January 12th, 1940. (545062.)

1107. "Systems for the automatic control of the speed of electric motors." British Thomson-Houston Co., Ltd. (Tokyo Shibaura Denki Kabushiki Kaisha). January 28th, 1941. (544991.)

1192. "Electric welding apparatus." Briggs Manufacturing Co. January 29th, 1940. (545063.)

1856. "Electro-magnetically operated electric switches." C.A.V., Ltd., and W. H. Glaser. February 11th, 1941. (545030.)

2552. "Electrical transformers." British Thomson-Houston Co., Ltd. February 29th, 1940. (544997.)

2967. "Ceramic articles suitable for use as electrical insulators." General Motors Corporation. May 31st, 1940. (544967.)

4662. "Adjustable carbon holders for arc lamps." J. Sturgeon. April 8th, 1941. (545097.)

5033. "Electrical condenser containers." Allmänna Svenska Elektriska Aktiebolaget. August 8th, 1940. (545036.)

5137. "Electrical outlet socket." J. F. O'Brien. April 20th, 1940. (545100.)

6118. "Remote-control arrangements." Aga-Baltic Aktiebolag. April 15th, 1940. (545038.)

6199. "Coils for dynamo-electric machines." British Thomson-Houston Co., Ltd. May 15th, 1940. (545101.)

6614. "Filament joint for electric lamps." British Thomson-Houston Co., Ltd. May 24th, 1940. (545103.)

8765. "Electrical conversion systems and the regulation thereof." J. Stone & Co., Ltd. July 12th, 1940. (545072.)

8766. "Systems for supplying alternating-current from a direct-current source, particularly

for use in railway vehicles." J. Stone & Co., Ltd. December 6th, 1940. (545073.)

9196. "Apparatus for loading sheath wire electric heating units." British Thomson-Houston Co., Ltd. July 20th, 1940. (545074.)

10109. "Automatic regulation of the voltage of synchronous generators." British Thomson-Houston Co., Ltd. August 10th, 1940. (545105.)

10132. "Kinematograph projection apparatus." Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). August 8th, 1941. (545106.)

10919. "Gas-blast electric circuit-breakers." British Thomson-Houston Co., Ltd. August 28th, 1940. (545111.)

Amended Specification

538118. "Automatic electric regulators." N. R. Davis and others.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — QUEENSLAND. — August 20th. Townsville. 3,000-kW turbo-alternator (Specification 119). A. Robertson, town clerk, Townsville.

Dumfries.—June 15th. Town Council. Equipment for British Restaurant and kitchen. Forms from burgh surveyor, Municipal Chambers; tenders to town clerk.

Glasgow. — June 13th. Clyde Navigation Trust. Supply of electrical and other stores from July 1st. Forms from stores superintendent, No. 1 Graving Dock, Govan; tenders to J. Wilson, general manager and secretary, 16, Robertson street.

South Africa.—SALISBURY.—July 2nd. City Council. Electrical metering equipment. (Contract E.19.)

KENHARDT.—June 24th. Municipality. Plant for electricity supply undertaking.

UPINGTON.—June 24th. Municipality. Electrical plant (alternator, switchboard, meters, crude oil engine, etc.).

Staffordshire. — County Council. Electric motors and drives at Hemmingslow Quarry, near Cheadle. (See this issue.)

Wolverhampton.—July 1st. West Midlands Joint Electricity Authority. 11,000-V overhead transmission line and 11,000-V underground cables. (See this issue.)

Orders Placed

Chester.—ELECTRICITY COMMITTEE. Recommended. Two transformers and switchgear (£1,615).—Metropolitan-Vickers.

Glasgow.—Transport Committee. Accepted. Canteen equipment: Dish washing machines, etc.—English Electric Co.; steaming ovens—English Electric Co., John Kelly & Son and Caterers' Appliances, Ltd.; potato peeling machines—John Kelly & Son.

Lighting Committee. Accepted. Annual stores, including electrical fittings and accessories (six months).—British Electrical & Manufacturing Co., Holland House Electrical Co.

Cleansing Committee. Accepted. Materials required for re-tubing two boilers at Govan (£1,196).—Babcock & Wilcox.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bingley.—Two British Restaurants at King's Hall and Cross Flatts; E. O. Robinson, architect, Town Hall.

Brighouse.—Alterations to schools for feeding centres and nursery classes (£1,356); H. A. Sneezum, borough surveyor, Municipal Offices, Commercial Street.

Cheetham.—Alterations to premises for factory; P. C. Larmuth, architect, 23, King Street, Manchester, 2.

Coatbridge.—Wartime nursery in Wallace street; burgh surveyor, Coatbridge.

Consett.—Miners' canteen, Derwent Colliery; H. Ayton & Sons, 5, George Street, Blackhill.

Jarrow-on-Tyne.—Pump house, etc., for the Mercantile Dry Dock Co., Ltd.—D. Glen, Back Queens Road, Jarrow.

Temporary additional classrooms (£2,160); borough engineer.

Leigh.—Workshop; A. E. Prescott, Ltd.; building contractors, Holden Road, Leigh.

Manchester.—Rebuilding works, Deansgate; H. Matthews & Son (Builders), Ltd., 129, Stockport Road, Ardwick.

Morpeth.—Houses; borough engineer.

Newcastle-under-Lyme.—Wartime nurseries; Pitfield House site; T. Hughes, builder, Bagnall Street. Crown Street, Silverdale; Phillips Bros. (Silverdale, Ltd.), May Street, Silverdale, Staffs.

North Shields.—Sawmills and wood factory; R. Burke, Singleton House, Northumberland Road, Newcastle.

North Walbottle.—Miners' canteen; R. Burke, Singleton House, Northumberland Road, Newcastle-on-Tyne.

Ossett.—Works extension; Gill Bros.

Patricroft.—Extensions to bakehouse; W. Richardson, 244 Liverpool Road, Patricroft.

Preston.—Alterations to premises for youth centre (£2,500); Rev. A. Gordon James, Wesley Chapel, North Road.

Rochdale.—Physical training and youth centre, Wesley School premises; S. H. Morgan, borough surveyor, Town Hall.

Sedgefield (Co. Durham).—British Restaurant, West Cornford; J. Tarren, surveyor, R.D.C. offices, Sedgefield.

Stirling.—British Restaurant; county architect, Stirling.

Tynemouth.—Reinstatement of damaged classrooms at Spring Gardens School; W. Stockdale, architect, 73, Howard Street, North Shields.

Physicists after the War

Sir Lawrence Bragg's Views

IN his address delivered at the annual meeting of the Institute of Physics in London on May 28th the president, Sir Lawrence Bragg, spoke of some of the many applications of science that had been brought to fruition under the stress of the war.

The main part of his address was, however, concerned with the future, basing his proposals on the assumption that mankind was at present in the throes of one of the great mutations of history. He thought that the oncoming technological age would require many scientists to continue as technologists into which they had had to turn themselves in these war years. He suggested that the present training of physicists would need considerable modification to produce more men suitable for that type of work. Anyone who had had experience as an internal examiner was familiar with the type of graduate who knew all about the constitution of the atom, but could not read a vernier scale, or perform simple exercises in mensuration. Industry, he said, wanted physicists who had some idea how thick a piece of copper wire had to be to carry a hundred amperes.

The Planning Committee of the Institute of Physics, over which he presided, was examining the whole question of the training of physicists after the war, although rightly, at present, many of its meetings were concerned rather with the present training and supply of physicists. A memorandum on training had been prepared to provoke open discussion, and copies would be available to non-members of the Institute on request. The president stated that his Committee would welcome suggestions, or criticisms, that might help it to frame proper recommendations. Sir Lawrence urged the constant interchange of physics students and staff from the Universities with a corresponding personnel from industrial and Government laboratories, and made some concrete suggestions for the realisation of that project. Physics would have to play an ever-increasing part in both our old established and newer industries if they were to be enabled to compete fairly in the world's markets after the war.

The annual report of the board of the Institute records continued growth in numbers and activities. One of the features of the year was the formation of the Industrial Radiology Group, the first subject group to be formed under the auspices of the Institute. This step has already been followed by the formation of an Electronics Group.

Large Transformer

Australian Company's Achievement

A 15,000-kVA ON/OB transformer, recently installed at the Croydon Road substation of the Electric Light & Power Supply Corporation, Ltd., Sydney, as part of the scheme to interconnect the major power systems of New South Wales, was built at the works of Australian General Electric Pty., Ltd. It interconnects the system of the E.L. & P.S. Corporation with the Five Dock substation of the Sydney County Council and is designed to control the flow of power in either direction. Although the nominal voltage ratio is 31 kV star to 22·7 kV delta, a tapping range from 28·9 kV to 39·7 kV was found necessary to take care of the voltage requirements for power flow in either direction.

The power flow is controlled by means of an Australian-built remote-controlled on-load tap changing mechanism operating over a range of 20 steps of approximately 1½ per cent., the tappings being arranged in the high-voltage winding. The mechanism is operated by means of remote push-buttons from the supply authority's substation and is equipped with remote position indicator, tap-change-in-progress indicating lamps and the usual control accessories.

The transformer has a self-cooled rating of approximately 12,000 kVA, above which air-blast fans come into operation by the contact of the dial type temperature indicator and control the temperature up to the full rating of 15,000 kVA. The whole equipment, including the fans, is of weatherproof construction for outdoor service. Radiators, which are of the fluted tube type, are bolted directly to flanges around the periphery of the transformer tank, each radiator being controlled at the top and bottom by individual valves, while each is provided with its own drain valve. The whole assembly is mounted on an undercarriage with flat tread rollers and fitted with ratchet barring gear.

The transformer, which is the largest yet manufactured in Australia, contains approximately 2,500 gallons of oil and weighs about 46 tons. The installation was carried out by the staff of the Electric Light & Power Supply Corporation in record time.

Forthcoming Events

Institution of Electrical Engineers.—*Western Centre.*—Monday, June 8th, 5 p.m. Merchant Venturers' Technical College, Bristol. "Brains' Trust."

Devon and Cornwall Sub-Centre.—Thursday, June 25th, 5.30 p.m. (tea, 5 p.m.), Callard's Cafe, 42, Fleet Street, Torquay. Paper: "Electrical Industrial Installations," by Mr. L. C. Grant.

North-Eastern Students' Section:—Saturday and Sunday, June 6th and 7th. Summer outing to Alston.

Electrodepositors' Technical Society.—Monday, June 8th, 5.30 p.m. Northampton Polytechnic, London, E.C.1. Paper: "The Brytal Process for the Anodic Oxidation of Aluminium," by Mr. E. Ensor.

Illuminating Engineering Society.—Thursday, June 11, 6 p.m. Imperial Hotel, Temple Street, Birmingham. Paper: "Street Lighting—Past, Present & Future," by Mr. G. H. Wilson, B.Sc.(Eng.), A.M.I.E.E.